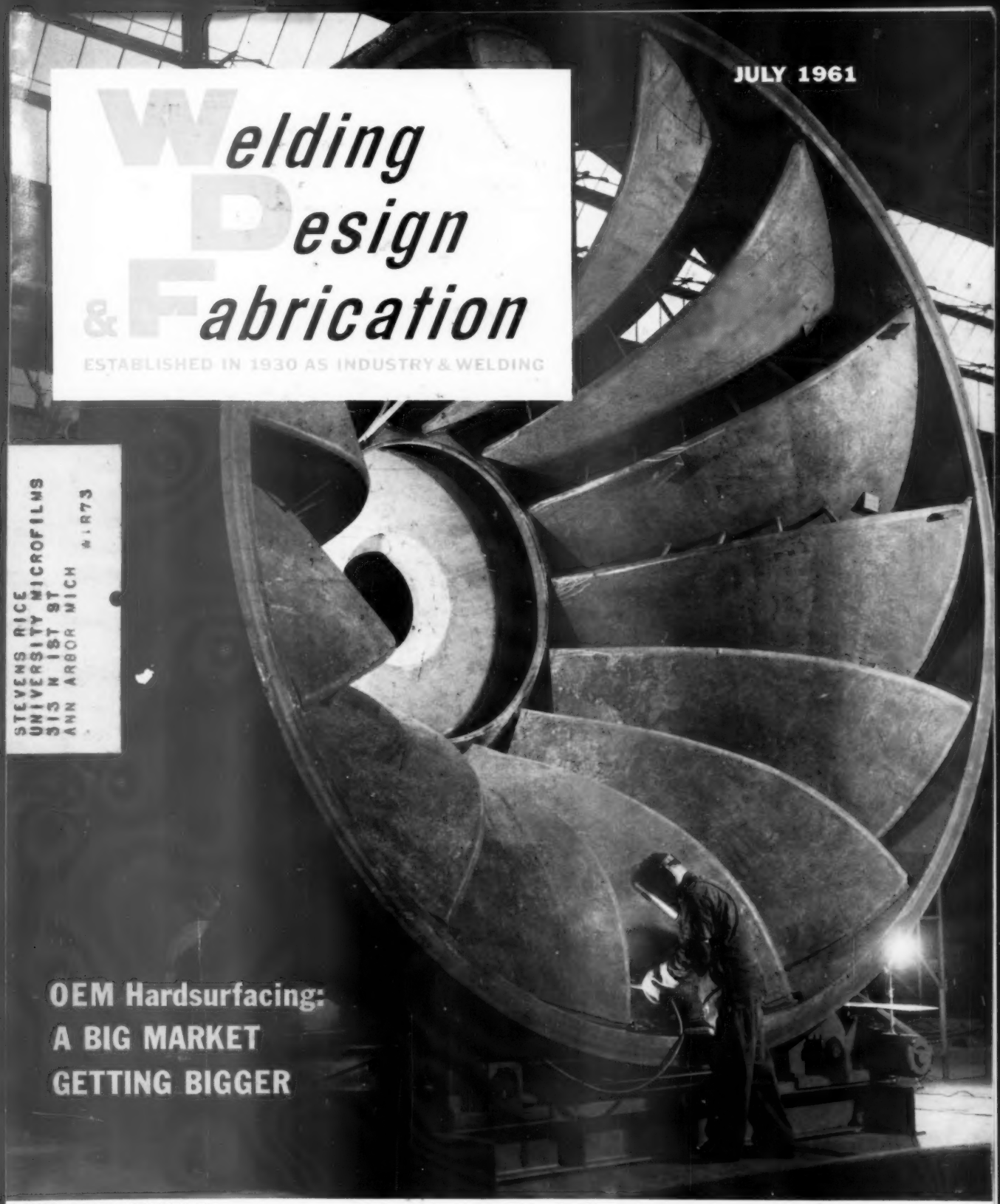

JULY 1961

# Welding Design & Fabrication

ESTABLISHED IN 1930 AS INDUSTRY & WELDING

STEVENS RICE
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## OEM Hardsurfacing: A BIG MARKET GETTING BIGGER

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

ALSO IN THIS ISSUE

AUTOMATIC WELDING IS VOLKSWAGEN'S SECRET

BRAZED JOINTS FOR AIRCRAFT HYDRAULIC SYSTEMS?

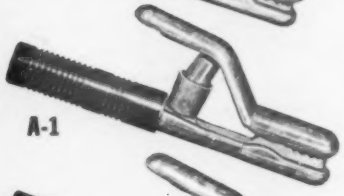
WELDED GIRDERS SOLVE DESIGN DILEMMA

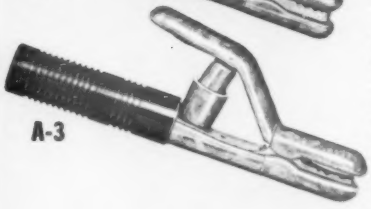
# "Pick The Jackson Holder That Suits The Job!"

The *right* holder will speed the work, boost weld quality, and cut welder fatigue.

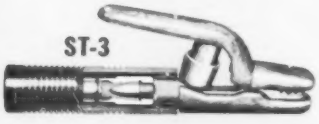
The right holder is one that's big enough to carry the required work load (determined by amperage, rod dia. and duty cycle), without burdening the welder with unneeded weight. The right holder for your work is one of the fourteen quality Jackson Holders listed below.

## HIGH-PRODUCTION HOLDERS

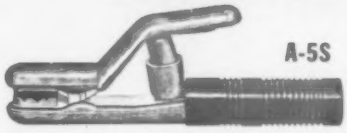


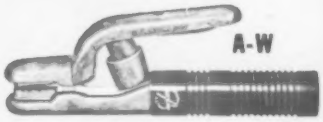




## SEALED TIGHT HOLDERS



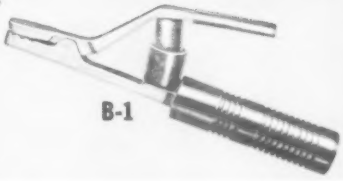
## FEATHERLIGHT HOLDERS




## STREAMLINED HOLDERS

## ECONOMY HOLDERS




| MAXIMUM CAPACITY AMPS | ROD | MODEL NO. | PRICE* | DESCRIPTION | |
|---|---|---|---|---|---|
| 200 | 5/32" | JH-1 | $4.50 | High-Production Holders (See Duty Cycle Table) | COPPER ALLOY |
| 300 | 7/32" | AW-C | 6.50 | | |
| 350 | 1/4" | A-1 | 7.15 | | |
| 450 | 3/8" | A-3 | 8.90 | | |
| 500 | 3/8" | A-3S | 9.20 | | |
| 300 | 1/4" | ST-3 | 7.90 | As above, with Sealed-Tight Connection | |
| 450 | 3/8" | ST-5 | 9.20 | | |
| 300 | 1/4" | A-W | 7.80 | Featherlight Holders | ALUMINUM ALLOY |
| 400 | 5/16" | A-5S | 9.10 | | |
| 200 | 5/32" | JH-2 | 7.50 | Streamlined Featherlight Holders | |
| 300 | 1/4" | JH-3 | 8.60 | | |
| 300 | 1/4" | B-1 | 5.15 | Economy Holders | 98% COPPER |
| 450 | 3/8" | B-3 | 6.65 | | |
| 400 | 7/32" | B-4 | 5.00 | | |

*All Prices Lower in Quantities*

HIGH-PRODUCTION HOLDER DUTY CYCLES

| HOLDER CLASS | MODEL NUMBER | ELECTRODE DIAMETER | AMPERAGE | CABLE SIZE | DUTY CYCLE |
|---|---|---|---|---|---|
| SMALL | JH-1 | 5/32" | 150<br>200 | 2<br>1 | 50% |
| MEDIUM | AW-C | 7/32" | 250<br>300 | 1<br>1/0 | 50% |
| | A-1 & ST-3 | 1/4" | 300<br>350 | 1/0<br>2/0 | 50% |
| LARGE | A-3 & ST-5 | 3/8" | 375<br>450 | 2/0<br>3/0 | 65% |
| EXTRA LARGE | A-3S | 3/8" | 500 | 4/0 | 80% |

*Sold Everywhere by Better Welding Supply Distributors*

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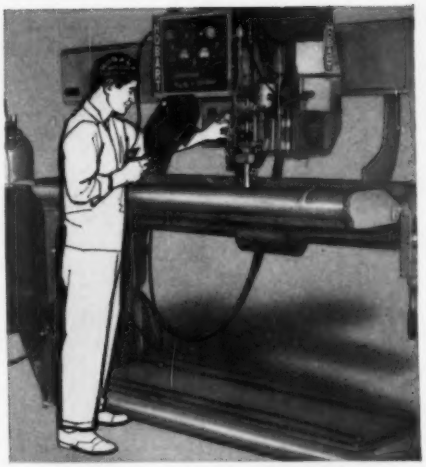
Welding process

**SEMI-AUTOMATIC** *Migarc*
Inert Gas Welding



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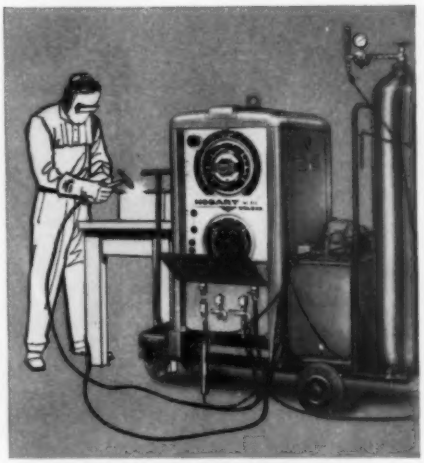
$CO_2$—Inert Gas or Fabricated Wire Welding

**SEMI-AUTOMATIC** *Manumatic*
for submerged or open arc welding

**DC WELDER/AC POWER COMBINATION**
for Shop or Field Welding



**AC OR DC METALLIC ARC WELDING**
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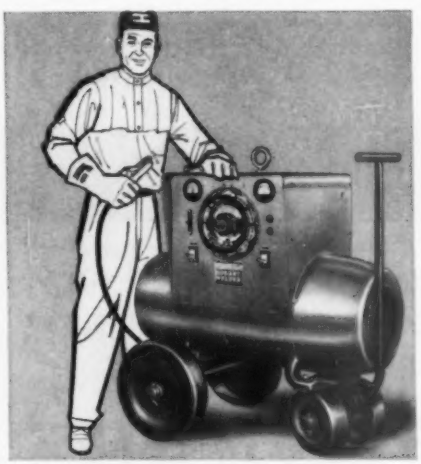
**AC TRANSFORMER ARC WELDING**



**DC ROTARY TYPE ARC WELDING**

**CHOOSE THE COMPLETE PACKAGE**
that best suits your requirements

**HOBART**
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Whatever your welding requirements, there's a complete Hobart package for handling it—power sources, electrodes, wire, flux, auxiliary equipment and accessories. **HOBART BROTHERS COMPANY,** BOX HW-71, Troy, Ohio, Ph. FE 2-1223. "Manufacturers of the world's most complete line of arc welding equipment"

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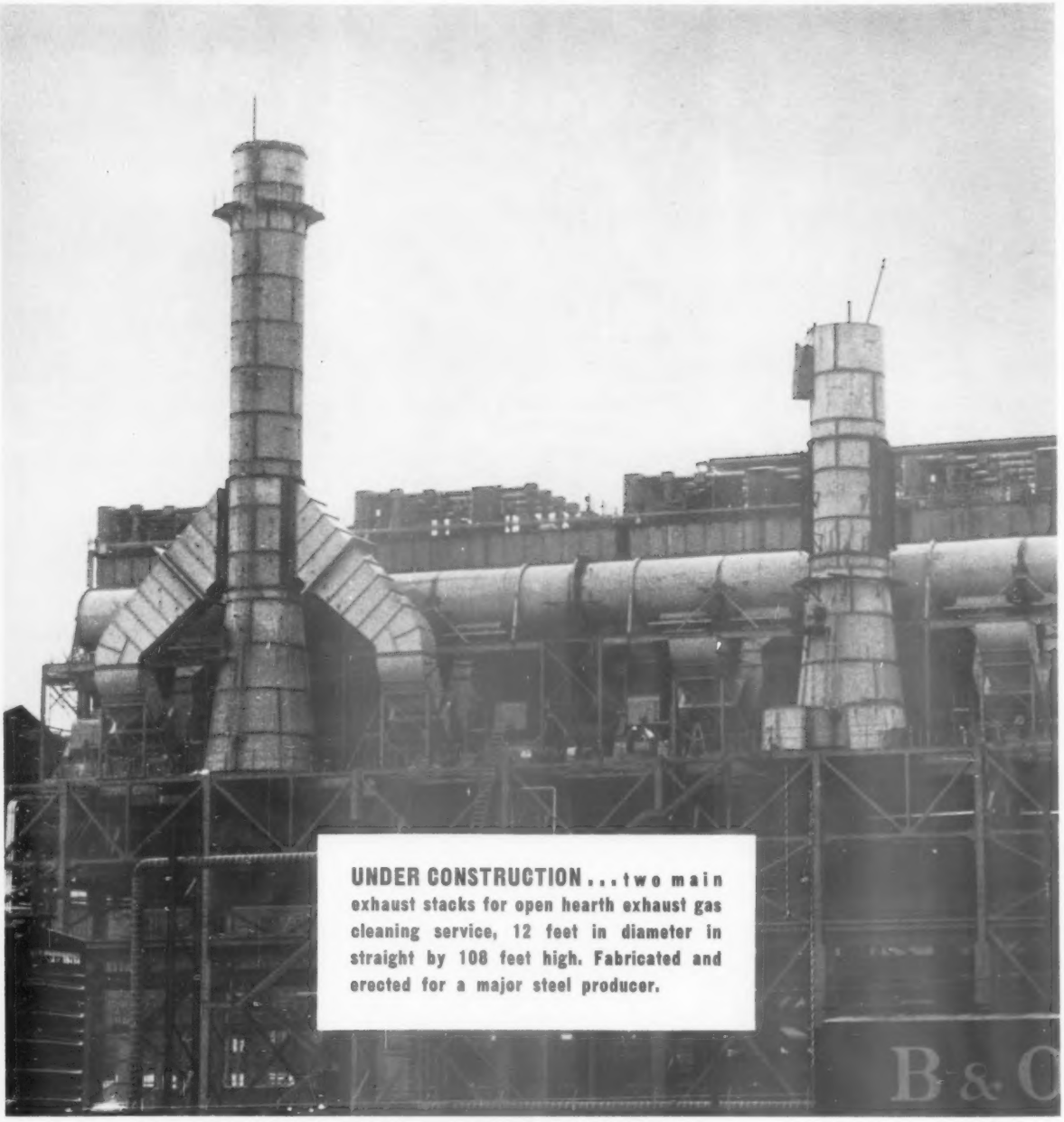
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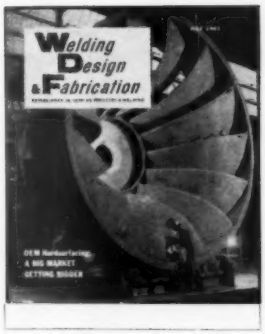


*for July, 1961*

**COVER:** Allis-Chalmers hardsurfaces critical areas of the blades of this 128,500-hp hydraulic turbine runner. The stainless overlay protects the blades against pitting or erosion—and a turbine usually runs for 30 years or more. Allis-Chalmers overlays the lower part of the blade before fabrication. After they weld the blades in place, they also overlay the fillets with stainless. See page 45 for a report on OEM hardsurfacing and creative applications of it.

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# Fabricating Precision Saves 25% to 35% of Secondary Machining Costs

Most heavy weldments are fabricated with 3/8" to 1/2" excess material to allow for secondary finishing operations. Here at Steel Fabricators Company, we work to 1/8" to 1/4" allowance! Figure what that can mean to you in terms of savings on machining and scrap loss!

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Yet the workmanship on these units was so precise, with the parts matching so accurately, that the manufacturer not only saved 25% to 35% of the usual machining costs, but he also was able to use the component parts interchangeably!

Our operators are currently doing Certified Armor-plate welding and fabrication... as well as arc welding of aluminum and alloys.

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Welding Design & Fabrication

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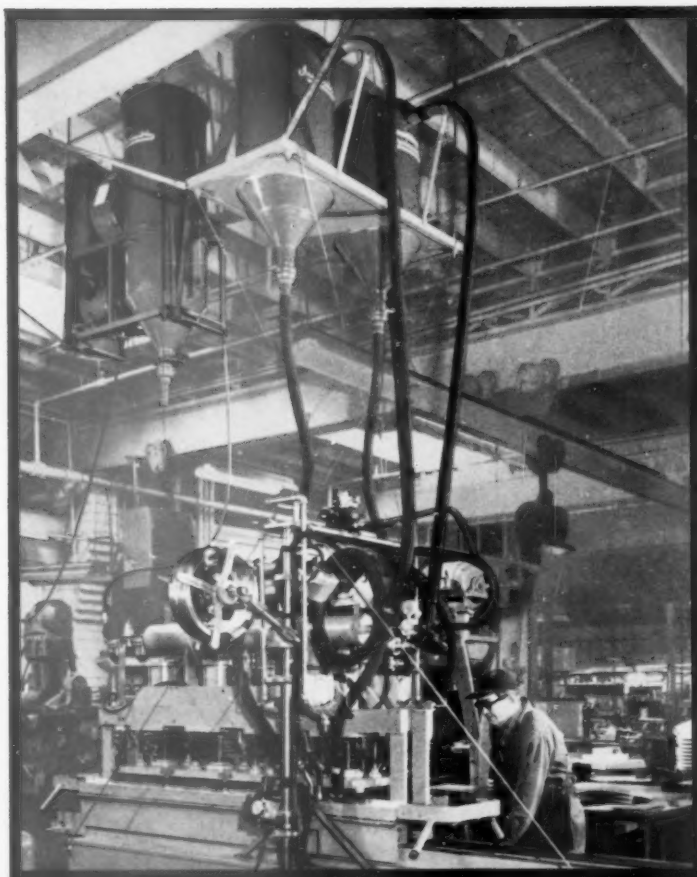
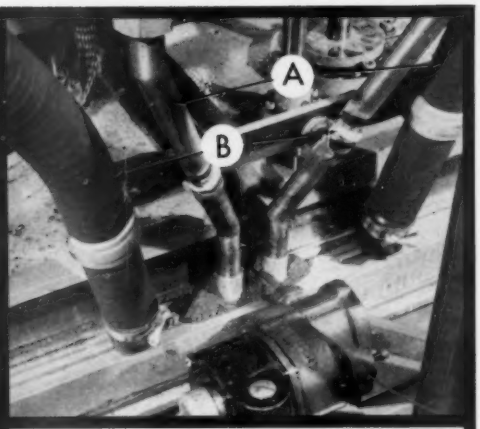
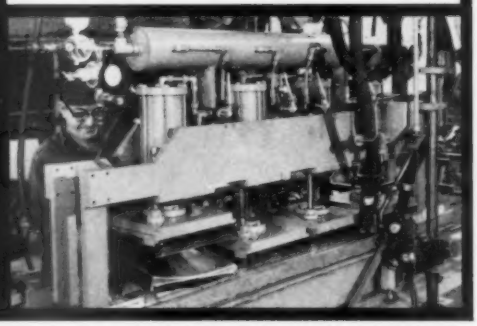





LEFT: Invincible compactness permits space-saving overhead installation. Flux recovery system has two primary separator tanks, one for each welder. Work carriage moves between welders. Heat exchanger sections are welded on both sides simultaneously, and flux is supplied and recovered on both sides.

ABOVE: Tube A feeds flux as Hose A recovers. When pass is completed, welded units are removed and new parts locked in place. These are welded on return pass. Direction of flux flow changes automatically so that Tube B feeds flux and Hose B recovers.

BELOW: Worker is removing a welded section.



*INVINCIBLE supplies steady flow of flux...*

# Production Is Increased 350%

This unique welding machine and the Invincible Flux Recovery System have solved a tough fabrication problem at Henry Furnace Company, Medina, Ohio. Two sides of irregular-shaped heat exchanger sections are now end-welded together simultaneously. Results of the automated operation include:

- **350% production increase**—875 sections can be welded per day as compared with 250 by the hand-welded method.
- **Strong, clean welds**—Invincible automatically supplies a continuous flow of flux to the welders. It recovers unfused flux, cleans it, and recirculates only dust-free flux to the work.

Invincible was chosen because its flexibility and large capacity meet the unusual job requirements. Heat exchanger sections travel between two welders and are welded in one pass of the carriage. These are removed . . . new assemblies are locked in place and welded on the return pass. Invincible supplies an ample flow of flux under all conditions.

There is a cost-cutting Invincible system for *your* submerged arc welding operation. Write us for a free survey. And . . .

***Send for Flux Recovery Equipment Folder***

# *INVINCIBLE*

*vacuum cleaner manufacturing co., Dover, Ohio*

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TINIUS OLSEN

The standard Charpy V-notch specimen is pre-cooled to a minus 10°F. and secured in the tester. A heavy pendulum weight is then dropped through an arc to strike the weldment. Many of the Easyarc 328 coupons stopped the pendulum cold — as shown both at the left and in the closeup view at the right, photographed at the moment of impact.

# Airco's NEW class E-7018 electrode stops Charpy tester cold!

## EASYARC 328—iron powder, low hydrogen electrode for mild steel

Welds made with Airco's new Easyarc 328 give you outstanding impact strength in all approved applications. The dramatic test results achieved recently in the widely used Charpy test show why—

Typical industry requirements call for a Charpy V-notch value of 20 ft.-lbs. at minus 10°F for welds made with E-7018 electrodes.

Put to this back-breaker test, the new Easyarc 328 chalked up 190 ft.-lbs. average! Many coupons stopped the sledgehammer blows of the Charpy impact tester cold!

Consider also the other plus values of Easyarc 328—Excellent usability in all positions . . . High rate of deposition . . . Low spatter . . . Easy slag removal . . . X-ray quality welds . . . Works with either AC or DC reverse polarity.

**Where Easyarc 328 will help you weld better** — On low alloy high strength steels . . . Hardenable steels . . . High carbon steels . . . High sulfur steels . . . Enameling steels.

Here is a "natural", too, for industrial piping, and restrained joints in thick sections of mild steel.

You are offered Airco's new iron powder, low hydrogen, mild steel Easyarc 328 as the finest E-7018 electrode on the market today. Designed to produce vertical fillets and butts with flat profile.

**Contact Airco** — for engineering data and samples of industry's newest Class E-7018 electrode—Easyarc 328.

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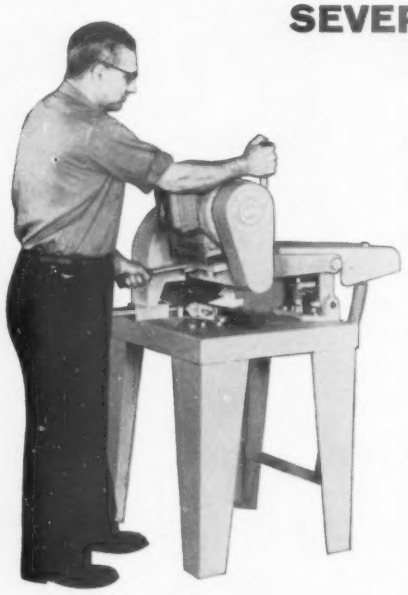
# 12 seconds per cut on this 2-inch steel bar!

## SEVER-ALL MODEL 1-A gives high-quality cuts at low cost



Even the newest super alloys can be cut at 3 to 6 seconds per square inch on the Sever-All Model 1-A dry abrasive cutting machine. The burn-free slices of hardened steel shown above are typical of the cuts you'll get on almost any metal. *You get this speed and quality for an investment of approximately $500!*

You get big capacity, too, with the Model 1-A—up to 2″ square solids, 3½″ O.D. pipe and tubing, 3″ angle iron and 4″ channels. You can cut practically any metal. On top of that, wheel oscillation—an "exclusive" in this price range—provides cooler cutting, longer wheel life.

The Model 1-A is so easy to use, too. Wheel selection is simple—just two types of wheels do *all* your Sever-All cutting jobs. Minimum set-up time required.

You can get immediate delivery from your Sever-All distributor. *Write* us for his name — or ask for **Bulletin DH-106** for details on the Sever-All Model 1-A.

**SEVER-ALL ABRASIVE CUTTING MACHINES**

ACCO

**Allison-Campbell Division • American Chain & Cable Company, Inc.**

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# WELDING MANAGEMENT

*watches these developments*

**VOLKSWAGEN'S WELDING SECRET!** That's what Chuck Berka, WD&F's editor, discovered recently when he flew to the Volkswagen plant in Wolfsburg, Germany, and interviewed Dr. Heinz Nordhoff, president, and Joseph Hoehne, production manager. You'll learn VW's secret, too, when you read the first part of Berka's 3-part report on welding at Volkswagen. It starts on page 27.

**COMMERCIAL PRODUCTION** of rolled channels, I-beams, and angles made from quenched and tempered alloy steel has been announced by U. S. Steel Corp. Shapes of T-1 and T-1 type-A constructional alloy steels, 9 percent nickel steel, and HY-80 naval armor steel are heat treated to design strengths as much as three times that of structural carbon steel. They promise important weight and cost savings in a variety of structural applications.

Discussing samples of the new standard shapes are U. S. Steel's Frank T. Bumbaugh, manager of alloy products sales (left), and Marcus M. Chapman, administrative vice president—commercial.

**USING POROUS FIBER METAL MATS,** metallurgists at Armour Research Foundation have developed a new brazing process which enable joints to be made in larger spacings. The new process, developed for the Association of American Railroads, is called fiber metal shim brazing. The fiber metal mats are prepared by suspending short lengths of metal fibers in glycerin, then felting them to produce a porous body. They can be pressed, rolled, and sintered. The mats are infused with lower melting brazing filler metal, and are placed in the joint to be brazed. The joint is then heated above the melting point of the filler alloy.

**DRAFTING PRACTICES** of industry and military are to be coordinated. The job will be done by American Standards Association's Sectional Committee Y14. This committee presently has 19 technical sub-committees which will develop uniform drafting practices in various engineering fields. Coordinating work between military and industrial standards falling within the scope of any of these technical subcommittees will be the responsibility of the newly formed coordinating subcommittee. In fields where no technical subcommittee exists, the group will undertake to develop proposals for coordination.

**LICENSE TO MANUFACTURE AND SELL** products of Cor-Ten steel has been granted Jones & Laughlin Steel Corporation by United States Steel Corporation. J & L will market structural shapes, light plates, bars, hot and cold rolled sheets, and galvanized sheets of the high-strength low-alloy steel.

In announcing the licensing agreement, U.S. Steel's Howard J. Mullin, vice president-sales stressed the advantages of the high-strength, low-alloy steel over structural carbon steel: 50 percent higher yield strength and four to six times the resistance to atmospheric corrosion.

**THE GLITTER NOW GONE,** aluminum is facing the same welter of problems faced by other American industries, reports *Dun's Review*. "From 1946 on," the business management magazine points out, "no industry was more glittering than aluminum." The struggle to keep abreast of demand kept the potline overworked and producers all growing apace.

But the excess capacity (700,000 tons) at the end of last year was a certain sign that the glitter is gone. In 1960, "competing materials were fighting hard to regain the markets aluminum had taken from them,"—and the competition is likely to be even more fierce in 1961.

# GLX-W COLUMBIUM-TREATED CARBON STEEL CUTS DEAD WEIGHT 10% IN NEW

*VERSATILITY...*
**That's the Beauty of Steel**

Bringing important new economies to rail shipment of automobiles, this new tri-level auto carrier holds twelve standard cars or mixed loads of 14 standards and compacts. Capacity is increased up to 75%. A unique system of hydraulically positioning the vehicles on three levels gives a clearance of only 16 feet 8 inches, permits use in areas formerly limited to bi-level unit operation because of clearance requirements. ◆ Key feature of the Multi-Car Carrier is the movable decks on which the cars ride. Made of GLX-W columbium-treated steel, the decks are raised and lowered by built-in hydraulic lifts, actuated by a portable power unit. Here light weight was essential, in order to reduce the operating power requirements. Yet great strength was necessary, too, to support the payload. Finally, design of the decks called for eight bends in each section. So formability was also a must. ◆ GLX-W met and exceeded all these requirements. It gives 50-100% greater strength than mild carbon steel, so builder Whitehead and Kales could get the required strength with less weight. Deck operating units need less power,

***Great Lakes Steel is a Division of***

*Multi-Car Carrier built by Whitehead and Kales for Multi-Car Corporation, Detroit, Michigan*

# TRI-LEVEL AUTO CARRIER

and total weight is reduced approximately 5,000 pounds or 10%. Production is more economical, too, because the ductility and formability of GLX-W permits four of the bends in the deck to be performed in one press operation. ◆ The GLX-W series of high-strength steels consists of fine-grained, semi-killed mild carbon steels, treated with varying amounts of columbium. The high strength of GLX-W permits designers to reduce the amount of steel and effect considerable cost savings when replacing mild carbon steel. GLX-W steels have a low carbon content and are readily weldable and formable. GLX-W steels are available at four minimum yield strength levels: 45,000, 50,000, 55,000 and 60,000 p.s.i. and in sheets, plates and bars. For complete technical information, write Great Lakes Steel Corporation, Product Development, Dept. WDF-9, P. O. Box 7310, Detroit 2, Michigan.

A PRODUCT OF

**GREAT LAKES STEEL**

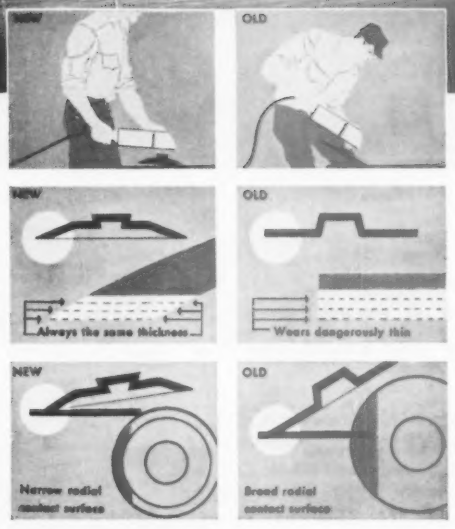
**Detroit 2, Michigan**

**NATIONAL STEEL CORPORATION**

**For More Information Circle No. 33 on Reader Service Card.**

# NOW LONGER WHEEL LIFE
## with new U-grade "KOOLIE HAT"

Now there are *two* "Koolie Hat" wheel formulations ... the tremendously successful R-grade for standard grinders and standard grinding jobs . . . and the brand new U-grade for up to 30% longer life on all materials. Designed specially for maximum effectiveness on high-speed, air-driven or electric portable grinders that operate at 5200 r. p. m. or more, Bay State's U-grade "Koolie Hat" wheel gives you the same speed, ease of operation and safety as R-grade . . . *plus* longer life on all materials.




◀ *Easier Operation* Koolie Hat wheel is held at 4° to 5° angle instead of 25° to 30°, requires less pressure, virtually eliminates jitter and bounce. Operator's position is much more relaxed.

◀ *Extra Safety* Koolie Hat shape wears evenly over all three abrasive layers instead of one at a time. Less danger of shattering due to heat cracks or thinning of wheel.

◀ *More uniform speed* Narrow radial contact surface between wheel and work keeps speed high for fast, efficient metal removal without heat build-up.

Get full details on the new U-grade "Koolie Hat" wheel from your Bay State distributor or factory representative *now. Better grinding at lower cost . . . that is their business.*

# BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts
*In Canada:* Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
*Branch Offices:* Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

**For More Information Circle No. 19 on Reader Service Card.**

This is a P&H engine-driven welder.
We make 10 different kinds.
All sizes. All good. All dependable.
Nothing fantastic about how they work.
They just weld good like they should.
Know why?

# We build 'em as though we were going to buy'em ourselves!

Know a better guarantee of quality?

**HARNISCHFEGER**
*Milwaukee 46, Wisconsin*
P&H WELDING PRODUCTS DIVISION

Hackney seamless high-pressure cylinders

Hackney seamless cylinders are formed from a single disc or billet so that the bottom is integral with the cylinder walls. There's little chance for leaks. They are ideal for shipping, storing and dispensing oxygen, argon, nitrogen, hydrogen, carbon dioxide, compressed air and many other compressed gases.

And because all Hackney cylinders are made the cold drawn way, surfaces are smooth inside and out, with crevices, hollows and ridges eliminated. Cleaning and painting time is reduced throughout the life of the cylinder.

Manufactured in strict compliance with specifications which exceed ICC requirements, Hackney cylinders are finished to your order as specified. For complete details, ask for a copy of the new Hackney cylinder catalog. It gives up-to-date information for all your cylinder needs. Write for your free copy today.

**Pressed Steel Tank Company**

*Manufacturer of Hackney Products Since 1902*

**1473 South 66th Street, Milwaukee 14, Wisconsin**

Branch offices in principal cities

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

**For More Information Circle No. 56 on Reader Service Card.**


# LETTERS

*to the editor*

## NONDESTRUCTIVE TESTING

Editor:

May I take this opportunity to compliment you on the quality of your March issue? I was very pleased with the editorial arrangement of my introductory comments.

My division manager suggested that I obtain six copies of that issue for circulation within the corporation. We feel this issue should be invaluable in educating our designers in both welding and nondestructive testing problems.

R. B. Oliver
Supervisor, Nondestructive Testing, Reliability and Quality Control,
Solid Rocket Plant
Aerojet-General Corporation
Sacramento, California

• *As president of the Society for Nondestructive Testing, Mr. Oliver wrote the introduction to our special report on how nondestructive testing saves time and money.*

## TEAR SHEETS, TEAR SHEETS

Editor:

Please send me tear sheets of the articles on "Techniques for Fabricating and Welding Aluminum Tank Cars" and "Techniques for Faster, Cheaper Welding of Heavy Aluminum Plate" which appeared in your January issue.

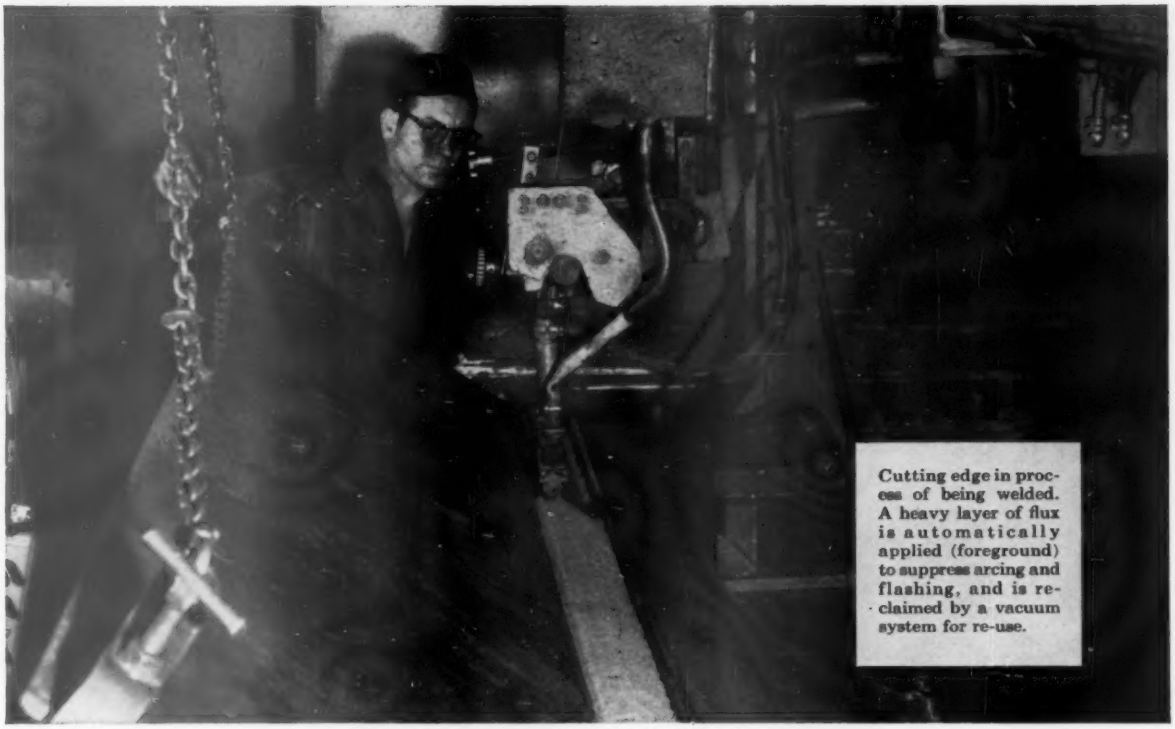
M. H. Robinson
*Welding Engineer*
*American Car and Foundry*
*Berwick, Penna.*

Editor:

We would appreciate receiving four additional copies of the following articles from your March issue: "Are You Buying Too Much Weld Metal?" "What Do You Really Know About Welding Specs And Codes?"

C. W. Myers
*Chief Inspector*
*Burgess-Manning Co.*
*Dallas, Texas*

• *These requests for additional tear sheets are typical of the numerous requests we receive each month.*



Cutting edge in process of being welded. A heavy layer of flux is automatically applied (foreground) to suppress arcing and flashing, and is reclaimed by a vacuum system for re-use.

## On heavy-duty buckets at Clark Equipment

# ONLY PAGE WELDS HOLD!

At the Construction Machinery Division of Clark Equipment Company, Page A-S-18 welding wire is used to weld cutting edges to bottom plates of buckets for the largest Michigan Tractor Shovels. That's because it was found that welds made with other wires would break unless the steel had been pre-heated. With Page A-S-18, steel can be moved from outdoors storage directly to the welding machine. Even on welds 140 inches long, Page holds every time!

## Let PAGE Help Solve Your Welding Problems

Now all Page automatic welding wire is color-coded by grade. The new labeling system simplifies inventory, cuts scrap loss—is another example of Page leadership in action.

From Page, you get over half a century of wire drawing experience and research—and from industry's widest selection of welding wire analyses, Page can furnish the right wire for your requirements. Every modern type of packaging is available. Prompt delivery is assured by a coast-to-coast network of Page distributors and warehouses. Bring your welding problems to Page—we'll be glad to help you improve your quality and lower your production costs.

***Write** us at Monessen, Pa. for information on the complete Page line of welding wire. Ask for Folders DH-402 and DH-1218.*

PAGE

PAGE

## WELDING WIRE

ACCO

**Page Steel and Wire Division • American Chain & Cable Company, Inc.**

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*, New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn. *Indicates PAGE warehouse stocks

*—the source for answers to welding problems*

**For More Information Circle No. 52 on Reader Service Card.**

# FOR FAST ACCURATE CUTTING

## Ohmstede SHAPE CUTTING MACHINES

**Model SC-42**
on semi-stationary base

- rigid construction
- complete - no extras
- AC-DC operation
- spindle and magnetic tracing

Your Choice of Two Models

Easy cutting of unlimited shapes . . . simple templet making . . . each machine a complete unit . . . easily moved, whether on a portable or semi-stationary base . . . manufactured of high-strength aluminum alloys giving stability and rigidity under all conditions . . . oversize, completely sealed anti-friction bearings . . . all these features make OHMSTEDE SHAPE CUTTING MACHINES outstanding.

**SPECIFICATIONS**

| | Model SC-30 | Model SC-42 |
|---|---|---|
| Overall dimensions | 36"x60"x58" high | 36"x72"x59 high |
| Max. thickness of cut with std. blowpipe | 8" | 8" |
| Circle cutting range | 0-30" | 0-42" |
| Straight line cutting | 65" | 89" |
| Cutting speed inches per minute | 3" - 30" | 3" - 30" |
| Electrical requirements | 115V - AC/DC | 115V - AC/DC |
| Net weight of machine only | 130# | 160# |
| Net weight with semi-stationary base | 438# | 553# |
| Net weight with portable base | 311# | 371# |
| Shipping weight | add 40# | add50# |

FOR COMPLETE INFORMATION
**WRITE - WIRE - PHONE...NOW!**
TErminal 3-6376 P. O. Box 2431
**BEAUMONT, TEXAS**

**Ohmstede MACHINE WORKS, INC.**
EST. 1905

**For More Information Circle No. 51 on Reader Service Card.**

# Dependability

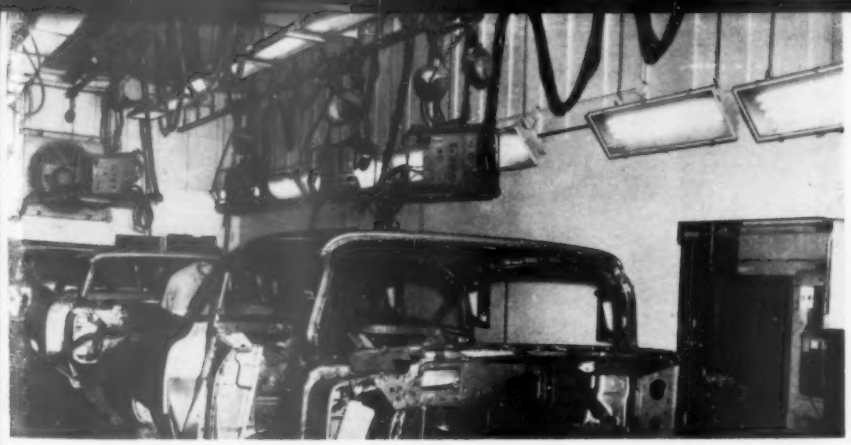
**See your distributor or write direct for catalog and prices**

*The Sign of a GOOD Hose Clamp*

**PUNCH-LOK Company**

**Dept. X, 321 North Justine Street, Chicago 7, Illinois**

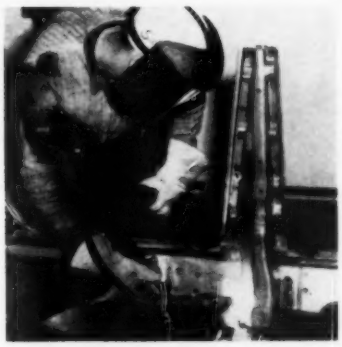
**For More Information Circle No. 57 on Reader Service Card.**



**CONTROL UNITS** for semi-automatic spot welding are rail-mounted above automobile body assembly line. Controls dispense electrode and prevent it from freezing in the weld pool or burning back into the gun. Operator (right) welds center post to body. All he does is pull the trigger of the rugged, water-cooled gun.

## WELDING AT WORK

*to do the job better and cheaper*



# 40% production time savings with consumable electrode spot welding process

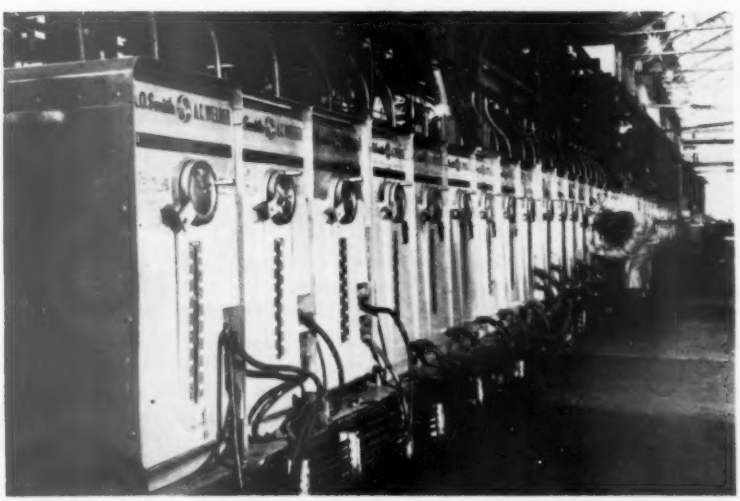
DETROIT: An automobile body plant has reduced production time 40 per cent with semi-automatic consumable electrode spot welding. The process is used to make 1,000 to 1,500 spot welds an hour and is 3 to 20 per cent faster than stick electrodes, according to National Cylinder Gas Division of Chemetron Corp.

Key to the process is automatic electronic equipment that overcomes the control inadequacies which have been major problems in consumable electrode spot welding on a mass production basis. The characteristics of the nugget-shaped weld are controlled by the time of arc duration and the electrode feed rate. Freezing of the electrode in the pool and electrode burnback into the gun are eliminated by a special burnback control circiut.

NCG reports that material costs are comparable to, or slightly less than, stick electrode tack welding or gas welding. Physical properties of welds are equal or higher. One spot weld nugget (5/8-inch-diameter) is said to be equal to one-lineal-inch of arc weld.

The process can be used to join low and medium carbon steels and low alloy high tensile steels from .035- to 1/4-inch. It can also be used to fabricate stainless and aluminum. The continuous electrode is solid or flux-cored wire from 3/64- to 3/32-inch diameter.

An argon-oxygen mixture or carbon dioxide alone are used as shielding gases, depending on the metals to be joined and the electrode used.



# Power for A-C arc welding

MILWAUKEE: Few companies use as many welding power units as A. O. Smith Corp. does. This bank of a.c. arc welders is used in the company's automotive production facilities and is only a small fraction of the equipment installed there. This installation consists of 96 units generating 400 amperes each.

# Now You Can Weld or Cut with a HELIARC "Tig-Twin" Kit...

When you own one of the new LINDE Heliarc "Tig-Twin" Kits, you're ready to take on almost any inert-gas-shielded arc welding or cutting job!

Use the lightweight torch for Heliarc welding. It's the fast, convenient method of joining ferrous and non-ferrous metals without flux. Then use the same torch to cut light-gage metals—without additional attachments.

Heliarc "Tig-Twin" Kits contain standard, high-quality LINDE components. They're designed to perform economically through years of trouble-free service. And the price is right. Talk to your nearby LINDE distributor now. Or write for his address to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. In Canada: Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

LINDE COMPANY

UNION CARBIDE

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For More Information Circle No. 46 on Reader Service Card.

# MEN ON THE MOVE

*in the welding industry*

## PROMOTIONS:

BAREFOOT

OBERST

MOEN

BRUSTLIN

The McKay Machine Company, Youngstown, Ohio, has made three executive promotions: **J. Roy Barefoot** has been named executive vice president, **Ralph N. Leitzell** is vice president and treasurer, and **D. M. Davis** is vice president in charge of special projects.

**Jack Oberst** is vice president in charge of sales of the Burdett Oxygen Company, Cleveland.

**W. B. Moen** has been appointed manager of Air Reduction Sales Company's Cryogenic Engineering Department, Plainfield, N. J.

**Harry G. Brustlin** is general sales manager of the Norton Company's Abrasive Division, Worcester, Mass.

The Trent Tube Company, East Troy, Wisc., a wholly-owned subsidiary of Crucible Steel Company of America, has named **Fred W. Beitner** vice president-sales, and **L. R. Miller** vice president-manufacturing.

**David B. Orden** has been named manager of Latin American operations for the International Division of Metal & Thermit Corporation, New York.

**S. S. Bruce, Jr.** is manager of Air Reduction Sales Company's national railroad sales department in Pittsburgh.

**Norman Fletcher** has been named branch manager in the Chicago territory of Gregory Industries, Inc. In Central and Eastern Canada, **Robert Igoe** has been appointed sales manager.

**Guy E. Sabin** has been named general sales manager for Omark Industries, Inc., Portland, Oregon.

**James C. Collins** has been appointed marketing manager of the Instruments Division of the Budd Company, Philadelphia.

**Charles Brown** is assistant sales manager and director of technical services for All-State Welding Alloys Company, Inc., White Plains, New York.

**V. B. Cassilly** is assistant manager-sales of the Tampa district, and **W. J. Kocher, Jr.** is assistant manager in charge of engineering services for the Minneapolis district for Air Reduction Sales Company.

**Walter T. McCoy, Jr.,** has been appointed manager of R. C. Mahon Company's regional sales-engineering office in Chicago.

**HONORS:**

**Elmer H. Smith** (second from right), founder of the Smith Welding Equipment Corp., Minneapolis, was awarded the James Turner Morehead Medal for 1960 at the 63rd annual convention of the International Acetylene Association.

*continued on page 20*


# make hundreds of bends

## *(simple–tough–complex★) with a*

## HOSSFELD Universal® Iron Bender

★The versatile Hossfeld Universal Bender makes hundreds of bends in round, flat or square bar stock, angle iron, pipe, tubing, and conduit. It's invaluable for maintenance, limited production work.

**OVER 150 STANDARD DIES**

Practically any everyday bend can be reproduced by the Hossfeld with one of the more than 150 standard dies available. This versatile Hossfeld bender sets up quickly, and is wrenchless for ready use. It's as indispensable as bench vise.

**3 MODELS** Available in a model to fit your particular needs: Hossfeld No. 1 for light shop work, Hossfeld No. 2 for heavier work, Hossfeld No. 2 with hydraulic attachment for tough hard-to-pull bends on heavy material.

This difficult bend in 4" flat stock was made easily, accurately.

**FREE** Illustrated Bender Bulletin. Write for yours today.

**HOSSFELD MFG. CO.**

436 WEST 3rd STREET • WINONA, MINNESOTA

For More Information Circle No. 39 on Reader Service Card.

# —your LINDE distributor!

Time is money, and your LINDE distributor is the man to save you a lot of both. He maintains complete stocks of equipment. They're top in quality—the LINDE brand name is your assurance of that. Whether it's for welding and cutting apparatus, industrial gases, welding rods, supplies, or accessories—you can count on your LINDE distributor to deliver what you want *fast*.

What's more, he can back up this service with sound, knowledgeable advice on welding and cutting. He's a welding supply specialist, an independent local businessman—*it's his business to know your business.* And for extraordinary problems, he can draw on LINDE's exceptional technological services which have been built on more than 50 years of pioneering in welding.

**A phone call from you is all it takes** to enlist his services. Look up your LINDE distributor in the classified directory, or write for his address to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

Your LINDE Distributor

***"Where One Call Gets It All"***

**LINDE COMPANY** UNION CARBIDE

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Circle No. 47 on Reader Service Card.

Your king-size weldment problems can be solved with Lewis king-size facilities and experience. We specialize in weldments from 1 to 35 tons and Lewis integrated facilities offer you complete design, welding and machining service for even the largest weldments.

**DESIGN**

Our engineering department includes weldment specialists experienced in machine design and cost-saving casting conversion. Lewis engineers will consult with your engineers from blueprint to fabrication of large custom weldments.

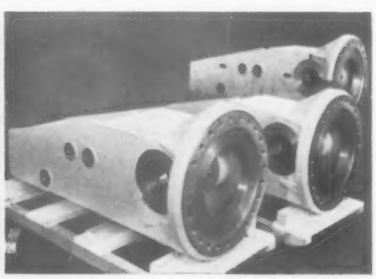
**MATERIALS**

Lewis is equipped to process both carbon and alloy steels and the usual commercially applicable non ferrous materials including monel, inconel and aluminum.

**MACHINING**

The wide variety of heavy duty machine tools of the Lewis Machine Division are available to you for the precise finishing of large welded structures and components.

Large flywheel fabrication



Precisely machined steel weldments

LEWIS

Please send me your booklet describing Lewis facilities. I am particularly interested in:
Design ☐ Weldments ☐ Fabrication ☐
Machining ☐ Special Machines ☐

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THE LEWIS WELDING & ENGINEERING CO.
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Title_____
Company_____
Address_____
City_____ Zone_____ State_____

For More Information Circle No. 44 on Reader Service Card.


## MEN ON THE MOVE

*continued from page 19*

### ELECTIONS:

**W. L. Killen,** vice president of manufacturing and engineering, Pressed Steel Tank Company, Milwaukee, was elected to the board of directors of the firm.

**C. G. Andrew,** vice president production-distribution for Air Reduction Sales Company, was named president of the International Acetylene Association at its 63rd annual meeting held recently in Boston.

### APPOINTMENTS:

**David H. Baker** has been appointed vice president and general manager of the International Division of Vickers Inc., Division of Sperry Rand Corporation, Detroit.

**Joseph J. Finnegan** has been appointed manager of the new product planning department of Graver Tank & Mfg. Co., Division of Union Tank Car Company, Chicago.

**Bruce D. Tyler** has been named to direct nondestructive training courses conducted by Magnaflux Corporation, Chicago.

### DEATHS:

**Max F. Richter,** vice president and manager of the Steel Warehouse Division of the R. C. Mahon Company, Detroit, died recently at his home in Livonia, Michigan.

**Edward H. McGraw,** Eastern district manager for the Chain and Electrode Division of The McKay Company, Pittsburgh, died recently after a brief illness.

**Ernest Edgar Thum,** 76, director of editorial services of the American Society of Metals, died suddenly, April 10, in Coronada Beach, California.

# New gaugeless regulators

**Available in VGS Single-Stage or VGT Two-Stage Models**

*1. Delivery pressure adjustment*
- —Simple and easy to adjust
- —Readable on two sides
- —Bold pressure readings stamped in cap
- —Bright, easy-to-read pressure indicator

*2. Inlet pressure indicator*
- —Enclosed and protected piston-type
- —Clearly marked Full to Empty scale stamped permanently into metal
- —Reliable 'O' Ring Seal

*3. Listed under Reexamination Service of Underwriters' Laboratories, Inc.*

The VGS400 series single-stage and VGT400 series two-stage regulators embody all of the time-tested and field-proved design characteristics that have made VICTOR Safety Regulators the choice of the man on the job. The use of pressure indicators instead of pressure gauges provides increased service for hard usage applications. Order from your Victor dealer.

| Single-Stage Models | | Two-stage Models | |
|---|---|---|---|
| VGS430-967 | 0-100 psig | VGT430-967 | 0-100 psig |
| VGS410-970 | 0-15 psig | VGT410-970 | 0-15 psig |

72

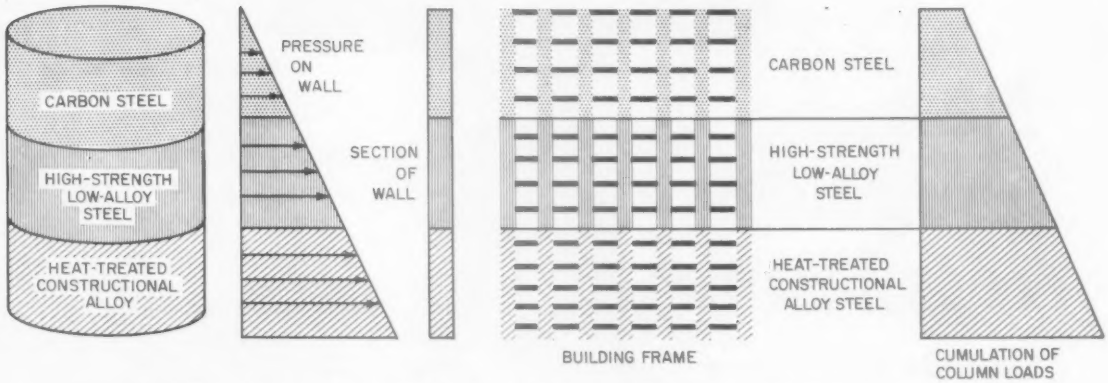
VICTOR for regulators

**VICTOR EQUIPMENT COMPANY** *San Francisco, California*
*Los Angeles, California, Chicago, Illinois*

MFRS. OF HIGH PRESSURE AND LARGE VOLUME GAS REGULATORS; WELDING & CUTTING EQUIPMENT; HARDFACING RODS; BLASTING NOZZLES; COBALT & TUNGSTEN CASTINGS; STRAIGHT-LINE AND SHAPE CUTTING MACHINES; ROLLER AND IDLER REBUILDING MACHINES

**For More Information Circle No. 67 on Reader Service Card**

# Fourth dimension is new approach to structural design




**FOURTH DIMENSION** is applied in design of storage tank (left) and the columns for a multi-story building (right).

PITTSBURGH: "Selecting the right steel or steels for the most efficient and economical structural design involves a fourth dimension which the designer must consider at the same time he considers design geometry." That's what J. A. Gilligan, structures engineer, told 500 design and materials engineers who attended a Steel Design and Engineering Seminar here. The Seminar was conducted by U. S. Steel.

"This fourth dimension involves the proper selection of materials from the many that are available today,"


# EMERSON ELECTRIC

NEW

## *PORTABLE 180c*

*A New High in Versatility... A New Low in Price!*

PORTABLE 180c WELDER

- **VERSATILE**—for use in school, farm, small shop or contractor on the move . . . for welding, brazing, soldering, heating.
- **LOW COST**—low, low initial cost...low operating and maintenance cost.
- **PORTABLE**—only 68 lbs. total weight...truly hand portable.
- **HIGH OUTPUT**—180 amps full output...78 O.C.V....75% power factor . . . six conveniently located heat taps from 60 through 180 amps.
- **COMPACT**—only 21¾" x 14¼" x 10" in size.
- **EMERSON-ENGINEERED TO LAST**—quality constructed . . . backed by famous Emerson Electric guarantee . . . carries U.L., CSA, REA approval—NEMA rated.

**EMERSON ELECTRIC** *of St. Louis*

8100 FLORISSANT • ST. LOUIS 36, MO.

***A Complete Line for Most Welding Needs***

**For More Information Circle No. 31 on Reader Service Card.**

Mr. Gilligan said. "In the past," he explained, "the designer was limited to a very few types of constructional materials and design was essentially a matter of geometrical considerations."

He suggested that engineers should not make arbitrary advance decisions to use certain well-known materials and then proceed to work out design geometry based on the properties of these materials. Instead, he submitted they should consider material selection and geometry at the same time.

"Only by proper consideration of this fourth dimension (material selection) can the designer produce the most efficient, safe, and economical structures," he said.

As an example, Mr. Gilligan asked the audience to consider the design of an oil storage tank. "Pressures on the tank walls range from zero at the top to a maximum at the bottom," he said. "If the designer chose ASTM A7 structural carbon steel for the tank walls," he explained, "the wall thickness would vary in steps from a minimum at the top to a maximum at the bottom.

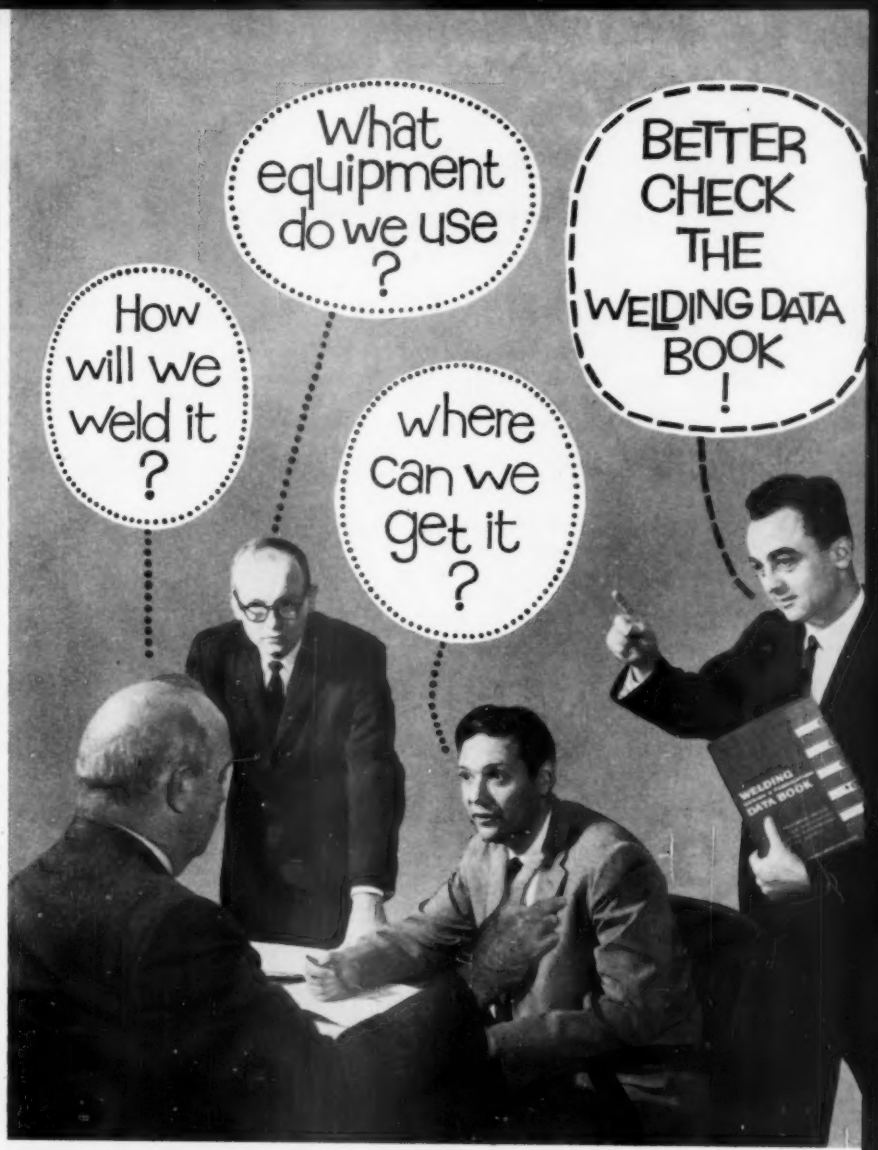
"By using the fourth dimension concept with the family of constructional steels now available," he said, "steels of different strength levels can be used to build a tank with uniform wall thickness from top to bottom."

He pointed out several advantages of this design concept: less plate material is needed; cost of shipping plate is reduced; welding costs are lower because of thinner plates; and maintenance costs are lower.

Mr. Gilligan explained the concept applied recently in the construction of a 600,000-barrel oil storage tank in Kuwait, on the Arabian Gulf. This tank was designed with a constructional alloy steel. Weight was reduced 42 percent and savings were made in fabrication, freight, and erection costs.

As additional examples of the fourth dimension approach, he cited a number of new buildings and bridges which have been built with two and three steels of different strength levels.

*more news on page 24*


# WELDING PROBLEM?

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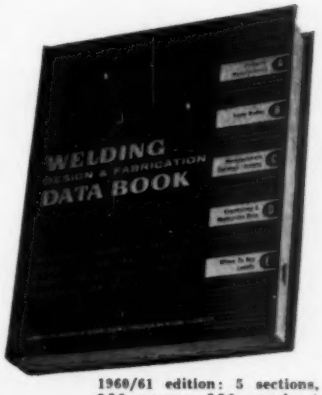


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**Welding equipment manufacturers: Ask for details on advertising your products and services in this important buyers' guide!**

# Highlights of NWSA's 17th annual convention

NEW YORK CITY: More than 600 members, wives and guests attended the 17th annual convention of the National Welding Supply Association held here in May at the Hotel Commodore.

Convention activities brought about these developments:

**A sales management program:** This will be built around a one-day seminar held in conjunction with each of the NWSA's six Zone Meetings. The program is intended to help welding supply distributors and their sales managers train their salesmen for more effective selling. This will be done with the help of a sales training manual which will be given each sales manager attending the seminars.

**A change in convention dates:** Starting in 1963, NWSA's annual convention will be held in late September or early October to avoid conflict with the American Welding Society's annual meeting and welding show held each Spring. When this change is made, Zone Meetings will be held in the Spring.

McLENDON

JACKSON

**Election of officers:** The new president is W. P. McLendon, Keenan Welding Supplies Co., Albany, Ga. Robert G. Jackson, Jackson Welding Supply Co., Inc., Rochester, is executive vice-president.

New vice presidents are Donald C. Berner, Welders Supply, Inc., Philadelphia; Leon Bush, Genesee Welding Supply, Inc., Flint, Mich.; J. W. Reynolds, Mankato Welding Supply, Mankato, Minn.; Dean Tillotson, Aweco Supply Co., Tucson; W. C. Rankin, Carolina Welding Supplies, Inc., Raleigh, N. C.; and Jack Bradfield, Sooner Supplies, Shawnee, Okla.

Directors elected for terms expiring in 1964 are James S. Cribbs, Tulsa Welding Supply Co., Tulsa; Arthur S. Owen, H. M. Parker & Son, North Hollywood, Calif.; Walter P. Sowers, Pocahontas Welding Supply Co., Bluefield, W. Va.; and Alex Stuart, Essex Welders Supply, Ltd., Windsor, Ontario.

Avery Seaman, Corp Brothers, Inc., Providence, was elected a director for a term expiring in 1962.

*more news on page 74*

Lightweight copper alloy welding tips.
"A Hot Tip ... Improve Your Welding & Cutting!"
DOCKSON TORCHES
Unique swivel nut holds nozzle at any angle
Expert workmanship, quality materials, perfect balance, rigid one-piece silver-soldered construction — Dockson offers the finest in lightweight, low cost torches built for long, dependable service.
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MODEL 5 WELDING TORCH
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Non-loosening extruded brass fluted handle.
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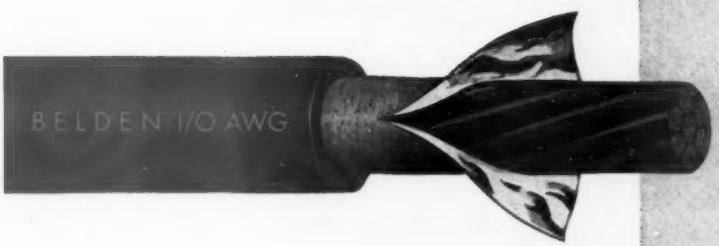
# Belden Welding Cable
## the Complete Line




**O.T.R. Rubber-Jacketed Cables**
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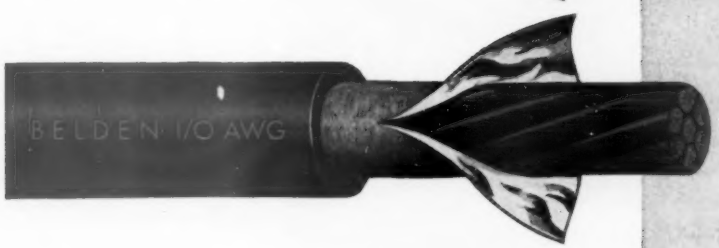


**Neoprene-Jacketed Cables**
Resist oil, grease, heat, sunlight, mechanical abuse, and ozone set up by high frequency welding or atmospheric conditions.

**HVF Vinyl Plastic-Jacketed Cables**
High voltage-frequency vinyl insulation affords perfect resistance to corona and ozone cracking . . makes this cable ideal for high frequency welding. High resistance to abrasion, oil, and impact.

**Whip Lead Cables**
Hawser lay construction of conductor makes this cable extremely limp and manageable . . minimizes operator fatigue. Jacket won't pull away from electrode holder. Neoprene insulation.

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58-1-9

# HUSKY to handle Petroleum Molecules

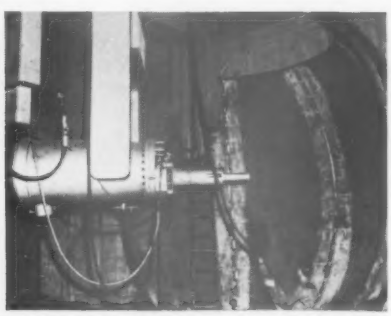
Hortonclad spherical reactor for a petroleum catalytic reforming unit.

**Welded Hortonclad spherical reactor for oil company catalytic reforming unit works under very high pressures. Chicago Bridge and Iron Company uses radiography to prove every seam sound.**

STURDY STUFF, this husky refinery unit. Seventeen feet in diameter, made of 3.65-inch-thick Hortonclad plate composed of ¼-inch 405 stainless steel on carbon steel. Seams between segments and end covers are welded—then radiographed to check for complete, continuous fusion.

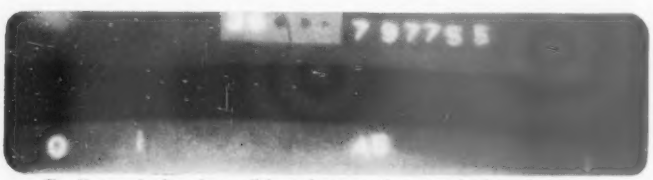
Welding is steadily taking on bigger and more important jobs and radiography is providing the proof of quality. If you would like to learn how radiography can save you time and help build business, have a talk with an x-ray dealer or write us for a Kodak Technical Representative to call.

Technician positions Kodak Industrial X-ray Film, Type AA.



2-million-volt x-ray unit set to radiograph intermediate seams.

Roundabout seam is radiographed with 50-curie pill of Cobalt 60.



Radiograph showing mild steel seam of reactor before cladding.

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JULY, 1961
Welding Design & Fabrication
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AN OVERSEAS REPORT

**VOLKSWAGEN'S SECRET** of success is explained to WD&F's editor by Dr. Heinz Nordhoff, president of Volkswagenwerk GmbH, Wolfsburg, Germany

# Automatic welding is Volkswagen's secret

**This is the first of three eyewitness reports by Chuck Berka, WD&F's editor. He tells the importance of automatic welding at Volkswagen, the famous manufacturer of compact automobiles. Next month, Part 2 will show how VW uses automatic resistance welding. Part 3 in September will cover automatic arc welding.**

CALL IT AUTOMATIC WELDING. Call it automated welding. Or call it mechanized welding. Volkswagen uses it to make a quality car at a reasonable price, a car that VW sells successfully in every country of the world.

That's the big thing I learned in April when I visited the VW plant in Wolfsburg, Germany. I talked to Dr. Heinz Nordhoff, president, and to Otto Hoehne, production manager. They told me automatic welding helps them turn out one car for every 60 hours of direct labor. It took 700 hours in 1948 when Dr. Nordhoff became VW's president. He has bettered the goal of 100 hours he set at that time.

The 36,000 employees at Wolfsburg produce 3,200 cars a day. This work force is 55 percent direct labor,

*continued on page* 28

## WELDING AT VOLKSWAGEN

*continued from page 27*

35 percent indirect, and 10 percent office. The plant works two 10-hour shifts.

VW has three more plants in West Germany. These produce trucks (about 800 a day), engines, axles, and transmissions. The VW plants also make parts for assembly plants in Belgium, Brazil, Ireland, Mexico, South Africa, the Phillipines, New Zealand, and Australia.

### ONE BIG ADVANTAGE

VW supervision was quick to tell me their one big advantage over Detroit. VW styles don't change much, so VW can go all out when they plan automatic lines. They don't have to retool every two years because of radical model changes. In fact, VW's production planning staff is much larger than its product design staff.

Here are some examples of the automatic welding I saw at the Wolfsburg plant:

Six highly automated lines turn out major subassemblies such as doors and roofs. The most dramatic of these is the line that makes three complete roofs (with braces and fittings welded in place) every minute.

I saw American shearing, forming, and cutting machines—Danly, Verson, McKay—in these lines. VW uses them along with special automated resistance welding and arc welding stations.

Throughout, VW feeds, ejects, transfers, and handles automatically. Helmut Amtenbrink, VW's chief trouble shooter and Mr. Hoehne's assistant, summed it up: "We make every operation as automatic as possible.

Besides these lines, VW has at least 20 other automatic resistance and arc welding lines for subassemblies. They make things like dash panels, rear and front end panels, front and rear hoods, gas tanks, and mufflers.

### AUTOMATIC RESISTANCE WELDING

The most interesting automatic resistance welding setups I saw at VW were two merry-go-rounds. One 8-station merry-go-round makes front end assemblies by joining various subassemblies. It has four loading and idling stations and four multispot welding stations. A similar setup makes rear end assemblies. This one has 10 stations—5 for loading and idling and 5 for welding. Each welding station makes about 60 spots at one time.

### AUTOMATIC ARC WELDING

The wheel line is the most interesting automatic arc welding line I saw at VW. It turns out 25,000 wheels a day, using automatic cutting, stamping, forming and $CO_2$ welding. This is in addition to automatic handling and transferring.

*Continued in August*

## *THE VOLKSWAGEN STORY . . .*

VOLKSWAGEN'S HISTORY is the story of three men: Ferdinand Porsche conceived the car; Adolf Hitler started a plant and a town to build it; Dr. Heinz Nordhoff made Volkswagen the most famous of the compact cars.

**Porsche** began designing the car in 1931. It was the orphan child of the German auto industry until middle 1930's. Then Adolf Hitler decided the Volkswagen fitted into his political machinations.

**Hitler** laid the plant's cornerstone in 1938. Immediately hundreds of thousands of Germans began buying savings stamps, pasting them into stamp books, which would entitle them to a car when filled.

The plant started production of military vehicles in 1940. During the war it produced 70,000 cars, along with parts for bombers and mines. By 1945 bombing had destroyed more than half of the plant.

The British finally occupied the town and the plant.

The plant was offered to each of the occupying Allied nations as reparations. No one wanted it. It was returned to the German government. In 1945, 1785 cars were made. In 1946 the total was 10,000. It was less than 9,000 in 1947.

**Dr. Nordhoff** became president of Volkswagenwerk on January 1, 1948. A graduate of the Polytechnic Academy in Berlin, he began his career as a design engineer in aircraft engine construction at Bayerische Motorenwerk, Munich. In 1930 he was appointed head of the service organization of Adam Opel AG, a General Motors subsidiary. He studied American production and sales methods with GM in America. By 1942 he was managing director of Opel's truck factory in Brandenburg, at the time the biggest in Europe.

When the Russians dismantled the plant, Dr. Nordhoff left. He became VW's president on January 1, 1948.

While German industry lay ruined and broken, VW succeeded in increasing its output. By 1950 production amounted to one-third of the total German vehicle production. By 1960 VW had a gross volume of 4,500 million D.M. ($1.1 billion).

# Low-hydrogen electrodes make sound welds in pressure piping

**INSPECT:** Pressure joints are radiographed and magnetic particle inspected.

**WELD:** Operator deposits 1/8-inch passes in hot pipe with dry electrodes.

**PRESSURE PIPING DATA**

| Line ► | Main | Reheat | Feed |
|---|---|---|---|
| Wall, inches | 2¾ | 1½ | 1¾ |
| Diam., inches | 18 | 30 | 16 |
| Length, feet | 225 | 310 | 300 |
| Welds | 39 | 38 | 75 |
| Stress Relief, F. | 1,300 | 1,300 | 1,200 |
| Operating Pressure, psi | 2,300 | — | 3,400 |
| Test Pressure, psi | 3,450 | — | 5,100 |

**IN BRIEF: High-pressure pipe welds demand competence in engineers and operators. These people control weld quality through joint design, choice of electrodes, heat treatment, and welding techniques.**

IF TRAVELS take you to Arkansas, south of Helena to the Mississippi, you'll see the giant Arkansas Power & Light Company electrical power plant that will tower 227 feet when it's done. This station, equipped with the world's largest single-shaft steam turbine, will generate 325,000 kilowatts.

Providing the path for steam from boiler to turbine is the job of the Grafe-Weeks Corporation, Pittsburgh. They're erecting the piping system. Actually, Grafe-Weeks is installing three major pipelines for the project: A main steam line to feed the turbine; a reheat line to superheat steam ahead of the main line; and a boiler water feed line.

## WELDS HAVE TO BE GOOD

The pipelines are big, thick-walled, complex. They must withstand high pressures. The gas-fired boiler makes 2,300,000 pounds of steam every hour. To deliver this much steam, some pipes will have 3,500 pounds pressure in them.

Grafe-Weeks engineers know welding metallurgy and they drew on this knowledge heavily in designing weld joints, selecting proper welding electrodes, and fixing preheat and stress relieving temperatures for the power piping. The company's welding operators were competent too. They had to qualify under the ASME Boiler Code.

This engineering and operating competence made the Pittsburgh Testing Laboratory's job of weld inspection easier.

Intensive Grafe-Weeks tests led to the selection of Air Reduction Sales Company's low-hydrogen electrodes for the critical welds. The operators welded mostly with AWS E8016-B2 (1.0 Cr, 0.5 Mo) electrodes in 3/32- and 5/32-inch diameters. But they made some welds with E7016 low-hydrogen electrodes. They stored electrodes in 400 F ovens.

## EVERYTHING HOT

The welding operators preheated electrodes and pipes to 500 F on the job. They heated the joints with water-cooled copper induction coils and measured temperatures with thermocouples attached to the joint. Asbestos kept the joints hot.

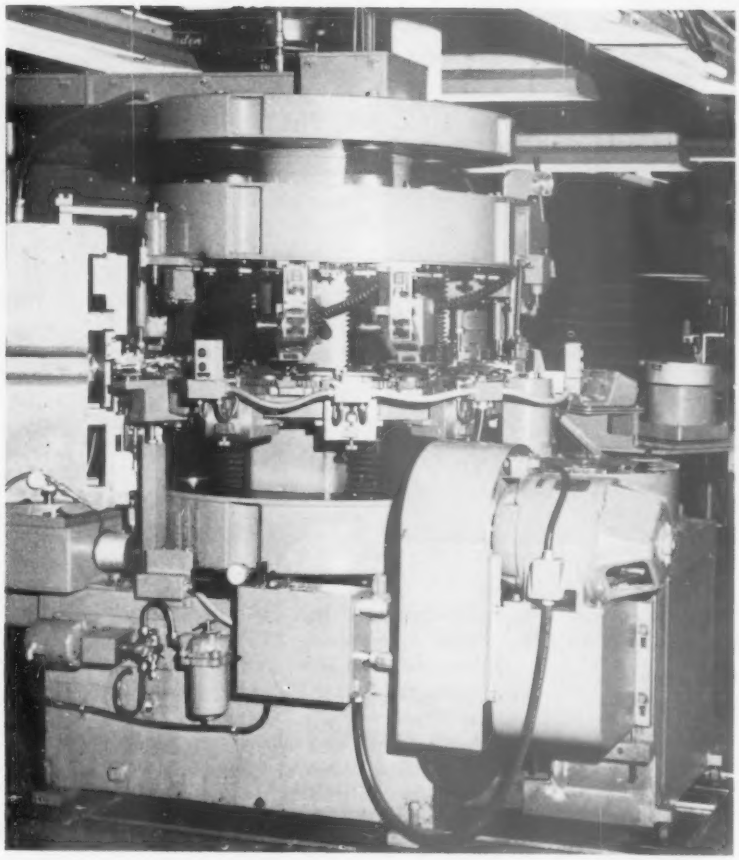
The operators made pipeline welds in U-grooves in 1/8-inch layers. They backed joints with chill rings and penetrated full-depth welds into them. It will take 152 welds to complete the job.

Grafe-Weeks stress relieves pipe welds on the job. They heat the main and reheat line joints to 1,300 F for one hour per inch of wall thickness. They heat the boiler feed line joints to 1,200 F in stress relieving.

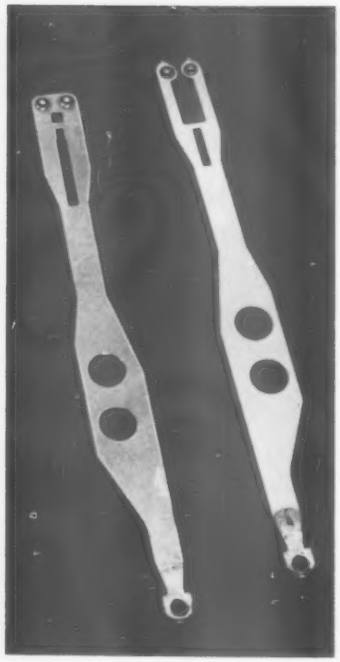
Finally, they radiograph each pressure joint and inspect it with magnetic particle equipment to be doubly sure of soundness. • •

# Automatic Resistance Welding:

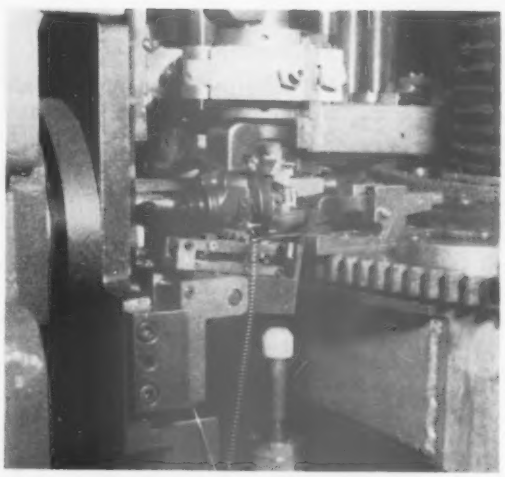
## the only way to make telephone



**THE PRODUCT:** Relay springs like these drop from the automatic processing machine at the rate of 3,600 every hour. The springs are nickel-silver and have two to four contacts welded to them. Forming, also done on the automatic, comes out ultra-accurate.



**36-STATION** spring processing machine has a magazine feed for the ultrasonically clean blanks. Parts dip an exact depth in solder, move through welding throats where silver or palladium contacts are welded to them from wire. Welding station (right) gets force from mechanically driven cams on upper and lower heads.



**OLD WAY:** It took batteries of machines and people to make contacts. These machines only make specials now.

# relay contacts at a one-second clip

**IN BRIEF: Making telephone relay springs used to cost a lot at Stromberg-Carlson: in space, in people, in equipment, and in time. Now they make two a second with two people on two 36-station automatic machines that fit in a small area.**

PUSHBUTTON WELDING isn't new at Stromberg-Carlson. They've pushed buttons for years at this division of General Dynamics Corporation in Rochester, N. Y. The difference: one push triggers a lot more action than it used to. Off the machines come finished parts in quick succession instead of unfinished installments.

You couldn't find a better example of pushbutton welding than the spring combinations that go into telephone relays. Relays, you know, are basic in telephoning. A central telephone office has hundreds of thousands of them.

Stromberg-Carlson makes most of its relay spring contacts on two automatic spring processing machines. Talk about speed: 3,600 of them drop from the 36-station machine every hour. And besides welding silver contacts to the flat (3-inch-long, 0.025-inch-thick) nickel-silver springs and coining the contacts, the machines tin the other end for connecting wires and form the spring to the right tension.

## OLD WAY

Spring making used to take a lot of time and a lot of floor space. It took rows of long benches for tinning . . . for welding and coining . . . and for forming the springs. It took many hot solder pots, dozens of 2½-kva resistance welders and coining presses, and batteries of small presses to form the springs. Besides space, it took people. A girl sat in front of each piece of equipment working the springs one by one. The girls made a lot of springs but they also ran up big bills for the company. Spring contacts were not cheap. Every spring got the personal touch in tinning, welding, coining, and forming. Only cleaning was done by the batch. To tin, an operator picked up a spring, dipped it into the molten solder (never the same depth twice), and tapped it to knock off the excess.

Each 2½-kva welder had a spool of silver wire feeding through the center of the welding gun. The operator put a spring into the carrier that moved it under the welding gun. The electrode descended, welded and cut the wire off. Then the spring moved to the coining station where it was formed into a smooth dome shape. The second contact was made the same way.

## NEW WAY

Besides being far faster, the new way of making spring contacts takes much less floor space than the old way. The two machines, their power supplies and controls, and an ultrasonic cleaner for preparing batches of springs before welding, fit into a 20- by 40-foot space. This concentrated production center releases thousands of feet of floor space.

Each machine has but one operator, a tremendous labor saving over the old way. He loads the magazine with stacks of ultrasonically-cleaned springs. The indexing table (moving once every second) picks up a spring from the magazine and starts it on its 36-stop way. First, tinning. Fingers dip each spring exactly ¼-inch into a demitasse-size lead pot. The solder is hot enough to adhere to the spring-end in just the right amount; no one has to tap off the blobs.

## FROM WIRE, SILVER OR PALLADIUM CONTACTS

After soldering, welding. In between, the spring moves so the contact side is up and out. At the welding head, fingers shove the spring between the electrodes and a silver wire clipping is welded to it. A coil of 0.025-inch silver, or palladium wire, feeds the welding head. A cutter nips the pieces to length. Each spring gets two or four contacts, so another clipping is welded to it at the second welding station.

Current is supplied to each welding head by two 5.5-kva transformers. Welding force comes from mechanically driven cams on the upper and lower heads. The electrodes are RWMA Class 3 alloy.

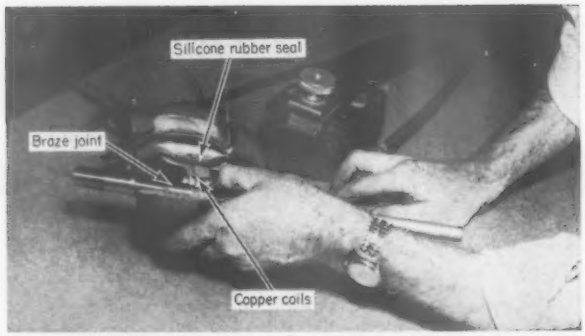
After the contacts are welded to the spring it indexes to the coining station. Here, a die works the rough contacts into smooth, shiny domes of exact height and width.

## SENSORS INSURE ACCURATE FORMING

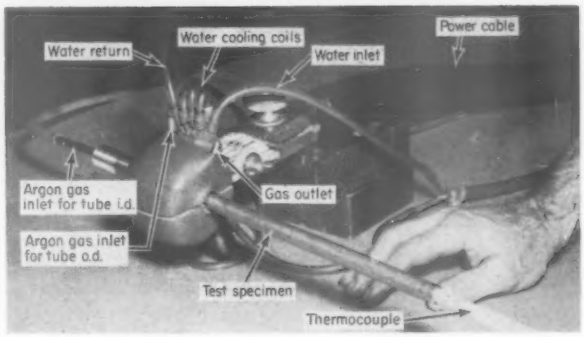
Next, forming. Forming dies bend the spring slightly, but accurately. If the bend is too little, sensors tell it. Then dies at a later station correct it.

Finally, finished springs drop from the machine, as accepted or rejected parts, at a one-second clip. Periodically the baskets are emptied and the springs are sent to be assembled into relays.

Stromberg-Carlson's way of teaming welding with other manufacturing steps in an automatic fixture is a good example for others. There's no better way—often no other way—to make large numbers of small, accurate parts. • •




**OPEN:** Portable induction tool is ready to put the bite on a tasty hydraulic joint. A shoulder on the porcelain palate lines up the tool on the sleeve.




**CLOSED:** Tool, quickly connected to the power line, has a firm, brazing-type bite on the joint. The tool is designed to keep the heat-affected zone within the joint sleeve.

# Portable induction brazing makes

**IN BRIEF: Why is Chance Vought developing portable induction brazing? Brazed joints are lighter and more reliable than threaded fittings, and brazed lines can go into places threaded lines can't.**

THERE ARE MANY REASONS why Chance Vought is studying brazed joints for aircraft hydraulic systems. Among them: Brazed joints weigh only half as much as threaded steel fittings; brazed joints are more reliable because they are permanent; and brazed lines can go where screw connections can't—through places like fuel cells and closed compartments.

Indeed, we have a Bureau of Naval Weapons contract to design and develop the processes, tools, and fittings for in-place brazing of hydraulic systems. In-place brazing means doing the work with portable tools right in the plane.

We chose a high-pressure, 4,000-psi system that runs hot and cold (450°F to —65°F) as the guinea pig. We decided that one size would give us all the information we'd need. The trick was to find the most suitable metal and design.

## THE METALS AND ALLOYS

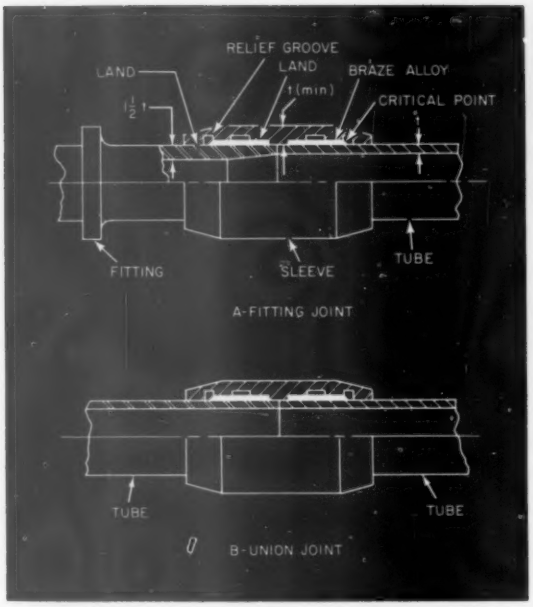
We worked with AM 350, AM 355, A 286, Inconel X, and 321 stainless steel alloys. We brazed with silver-copper-lithium alloys. The AM alloys are the strongest for their weight; 321, the weakest. But we used 321 for a reference metal because it brazes the best. Next to 321, AM 350 and 355 braze the best.

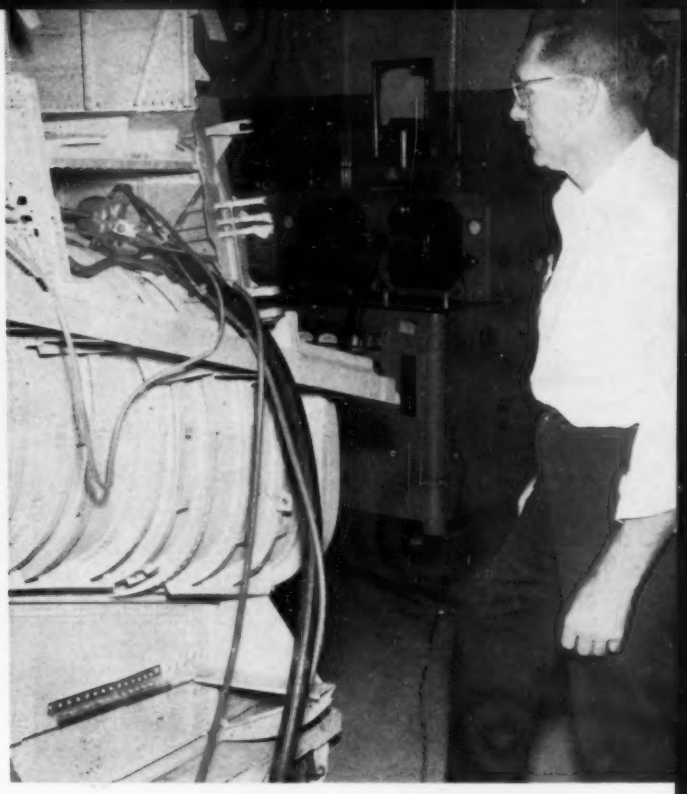
The brazing alloys melt at 1,450°F. This is hot enough to anneal the AM alloys. In 10 seconds at 1,600°F the ultimate and yield strengths can drop from 200 and 175 ksi respectively to 175 and 45 ksi; and with it, resistance to fatigue. Moreover, we believe that AM 350 and AM 355 lose ductility at —65F, a further blow to fatigue strength. We considered using an aging treatment that overcomes some of the ill effects of brazing on these alloys.

Inconel X and A 286 lose strength in brazing too, but not as much as the AM alloys; 321 is bearly affected. Due to 321's stability in brazing, and the lack of it in the other alloys, we completed our program using 321.

## A FITTING DESIGN

We designed two basic 321 stainless parts: a fitting for tees, elbows, and crosses (sketch A), and a union (sketch B). The symmetrical sleeve suits all brazed joints. We grooved the sleeve to allow the brazing alloy to fillet. We allowed 0.0015- to 0.0035-inch clearance between tube and sleeve for alloy flow. We



**BRAZING THE JOINTS** (above) on the aircraft (right) is easy. The operator steps on the starter pedal and the induction machine (background) takes over.

# better hydraulic joints

says **C. G. BROCK,** *hydraulics design group, Chance Vought Corp., Vought Aeronautics Div.*

figured the wall thickness of ½-inch tubing using 8,000-psi yield pressure and the minimum yield strength of the metal, at 0.065 inch. But by using the ultimate strength and 16,000-psi burst pressure, the wall was thinner.

Lands in the sleeve assure a gap for the brazing alloy no matter how the sleeve fits or lines up. At the very least, the shear strength of the brazing alloy (at 450°F) equals the burst pressure acting on the cross-section of the tubing. We originally based joint strength on longitudinal and hoop stresses in the sleeve, resulting from this burst pressure. When we learn what bending stresses result from vibration (deflection) tests, we'll change the design to suit. During testing, the outside land on the sleeve transfers the load through the sleeve. This reduces bending in the tubing.

## BRAZING PROCESS AND EQUIPMENT

We braze with portable induction coils that envelop the joint. Resistance to induced a.c. current does the heating while argon gas floods the joint and prevents oxidation.

Good wetting is important to brazing because it prevents voids. And cleanliness and the amount of lithium in the brazing alloy have a lot to do with wetting. We prefer chemical cleaning to mechanical. We find that a brazing alloy with at least one percent lithium flows and wets the best. We can get by with 20 percent voids as long as they're scattered. Bunch them, and a joint could easily fail from high internal pressures.

We designed the brazing coils to limit the amount of heat effect in the joint. Keeping the coils narrow helped. But they could be only so narrow, and there was the chamber configuration to think about. Actually, we compromised between these things and fitting design to keep the heat effect within the sleeve.

It's easy to use the split-coil brazing tool for in-place brazing. It's shaped like a clam shell and has a purge chamber and heating- and water-cooling coils. There are four flat, series-connected heating coils insulated from each other by phenolic spacers. The coils are encased in a porcelain housing. Each half of the tool contains closed coils. The ceramic chamber conforms to the brazing fitting, allowing a 1/32-inch gap for induction heating and argon flow. The gap between fitting and coils and their relative position are critical; it means a brazing tool for different fittings.

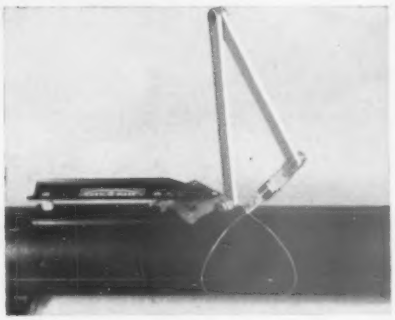
We braze 321 stainless with a 5-minute argon purge, heat for 15 seconds, and cool 2 minutes. When the joint cools to 400°F we remove the brazing tool. Our induction machine is a 10,000-cycle, 30-kw unit. Brazing time depends on a machine's frequency: the higher

*continued on next page*

# CURV-O-MARK

## CONTOUR MARKER

Marks off any pipe joint or structural angle. Cut accurately, easily and without figuring cutbacks. Marks all around pipe. Saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diameter.



### Combination Adaptor Accessory for Contour Marker

This new tool patent will prove to be a great advantage to the layman, allowing him to use all four sides of the Contour Marker in layouts on pipe or structural steel. It allows him to mark up to 30" pipe with the standard model without having to quarter or halve his pipe as he has had to do in the past. It allows him to mark over nipples, old welds, without having to break the wrap so far back on wrapped pipe.

It allows him to mark compound angles in one setting of the tool, also to mark off any portion of tube turns or 90 degrees he would so desire, as you will note in self-explanatory pictures.

The combination adaptor will also be furnished for the Jumbo Contour Marker on special order.

This tool will be sold by your welding distributor as an accessory to the Contour Marker.

### Pro - Mag - Level

This level is designed for the fitter, welder, jig builder, for any layman who has angle or setting problems. The Pro-Mag-Level is 9" in length, 2" high, ¾" wide, weighing a total of 10 oz., a convenient pocket size. One side is machined to a flat plane for flat surfaces, the other side is machined to a slight V-plane for pipe work.

Body of level is made of strong aluminum casting to maintain lightness of tool. Scales are imprinted on one end for rise in degree per foot, on the other end degrees in rise per meter are imprinted.

Equipped with level and 90 degree dial marked in 2½ degrees, held in place by screw with pressure washer for easy setting.

Frame of level is equipped with two magnets on each plane for holding level in desired position, allowing the layman a third hand. Pictures of tool are self explanatory.

## CONTOUR SALES CORPORATION

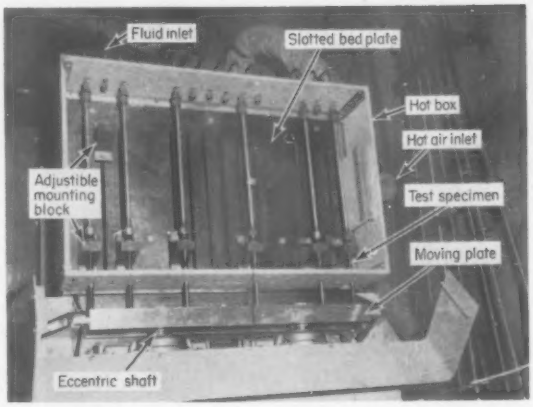
**1843 East Compton Boulevard** **Compton 2, California**

See Your Welding Supply Dealer For All Curv-O-Mark Products

**For More Information Circle No. 25 on Reader Service Card.**


## INDUCTION BRAZING

*continued from page 33*




**SHOOK:** Induction-brazed joints mounted in this testing machine not only are vibrated 1,750 cpm at 450°F, but they also get 6,000-psi hydraulic impulses at 35 cpm.

the frequency, the shorter the time.

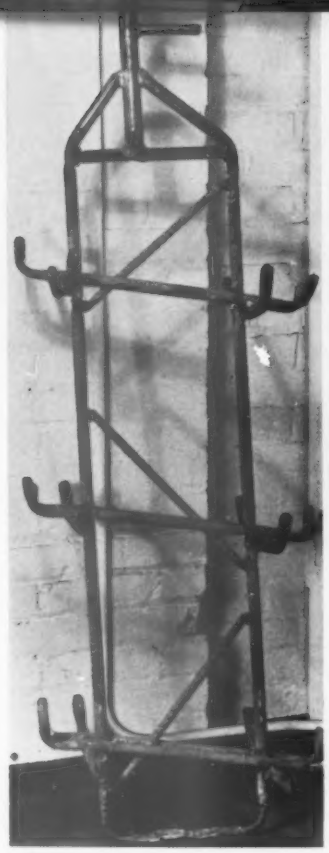
Obviously, induction-brazed joints have to be as strong as standard threaded or brazed joints. The best way to compare them is with vibration, pressure-impulse tests. These tests, based on the requirements of military specification MIL-F-18280, gave us fatigue data to compare. We vibrated the 321 stainless specimens at 1,750 cpm and, at the same time, shot 6,000-psi impulses through them at 35 cpm. Fluid and ambient temperatures were 450°F during these tests. With the deflection fixed, we varied the specimen length to vary the stresses at the critical point in the tubing. This is the last point of tube support inside the fitting where the brazing alloy stops. Then we plotted fatigue curves.

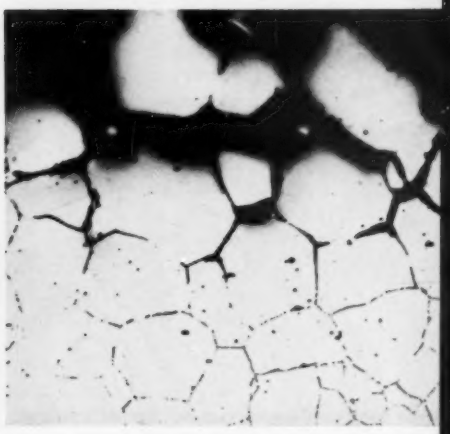
Our rotary deflection machine works in connection with hydraulic impulse equipment. We attach twelve test specimens to the machine's moving plate (see photo). Eccentric shafts rotating through this plate move it in a circular path. We can also vary stresses in the test specimen by moving it in or out with respect to the moving plate. We heat the specimen, enclosed in an insulated box, with a hot-air blast. We connect hydraulic pressure lines to the ends of the specimens to fire pressure impulses.

With high strength materials, in-place induction brazing needs closer control and better planning than threaded connections do. The length and alignment of tubing is important, but aligning tools aren't practical. It takes care. We help ourselves by bench brazing as many assemblies as possible; induction brazing only the final joints on the aircraft.

### RELIABILITY: OUR GOAL

We are after reliable brazed joints. When we can make good ones every time, we'll have it. But you can't prove reliability with one program; it will take several. In the meantime, we'll inspect many brazed joints with x-ray, eddy currents, ultrasonic, besides visual and pressure tests. Once reliability is proved, brazed joints will become standard. • •





**Don't let this happen to you . . .**

*A large pickling rack (left) fabricated from ¾-inch rods of Type 316 stainless steel shows accelerated corrosion at the heat-affected zones of the weld joints. The enlargement of one of the weld joints (above) clearly shows how little corrosion resistance sensitized metal has—destruction is almost complete. The photomicrograph (above right—original magnification 250X) shows the intergranular chrome-carbide paths corrosion follows in putting an end to the usefulness of the rack. Corrosion detaches whole grains from the metal.*

*Equally corroded are the bends at the bottom of the rack. Torch heating precipitated carbides; acid chewed them out.*

# Control carbide precipitation when you weld stainless steel

by **G. E. LINNERT and R. M. LARRIMORE, JR.**, *Research Laboratories, Armco Steel Corp.*

**IN BRIEF: The authors discuss three sure ways to avoid intergranular corrosion caused by welding heat: Heat treat, use stabilized stainless, or use stainless with extra-low carbon.**

FABRICATORS of austenitic stainless steel know the damage intergranular corrosion resulting from carbide precipitation can do near welds. What they may not know is how to prevent it.

Carbide precipitation comes from heating stainless to between 800 and 1,600 F. Carbon migrates to the grain boundaries and forms chromium carbide. Loss of chromium next to the boundaries makes this area vulnerable to corrosion. Another name for it is sensitization. And electrolysis between the chromium carbides and the surrounding metal worsens the corrosion.

The danger range is actually narrower than 800 to 1,600 F. Reason: In welding, heating and cooling are fast. In welding, the sensitized band is ⅛ inch from the weld. Welding heat anneals the metal next to the welds and it cools fast enough to hold carbon in solution.

A sensitized weld joint may be worse than it looks; you can't tell how deep the carbides go from the looks of the surface metal. And though damage may be confined to a narrow band, it's serious.

The engineer that shortcuts control of carbides is only kidding himself. There are only three effective controls: solution anneal after welding, stabilize the carbon with elements like columbium, tantalum, or titanium, and use of an extra-low carbon stainless steel base metal.

## HEAT TREATMENT

Heat treatment is the common way to avoid intergranular corrosion in stainless steels. You anneal the weldment between 1,850 and 2,050 F to dissolve carbides and to restore chromium to the grain boundaries. The exact annealing temperature depends on the grade of stainless. The time at heat depends on the thickness of the metal. The shorter the heating time the better. It avoids grain growth.

*continued on next page*

## CARBIDES IN STAINLESS

*continued from page 35*

Rough rule: Three minutes for every tenth inch of thickness. Then, cool the weldment rapidly through 800 F to hold the carbon in solution. Water quench heavy sections, air-cool thin sections.

But annealing has disadvantages. Two of the worst are distortion and the difficulty of quenching. Another, when the parts are oxidized, you must pickle or sandblast them. And don't overlook the possibility of weld repairs: If they're necessary, you might have to anneal the whole weldment to eliminate carbides. This can be done only if the furnace is big enough.

Maybe you anneal to relieve stresses. The need to stress relieve austenitic stainless steel weldments is overemphasized. We know of many as-welded vessels that work fine without it. We know of annealed vessels—most have heavy walls—that cracked badly near the welds. Aware of this, the ASME Unfired Pressure Vessel Code, Section VIII, no longer insists on stress relief.

You might heat treat to prevent stress corrosion. Stainless, like many other metals, can crack from stress corrosion. It's hard to decide how it starts and how to avoid it. Usual practice with regular-carbon stainless is to stress relieve between 1,850 and 2,050 F. Less heat might sacrifice corrosion resistance. But there's some evidence that rapid cooling from a high temperature actually stresses the weldment—even to the point of encouraging stress corrosion.

Obviously the fabricator would much rather reduce stresses and eliminate carbides with less heat and slower cooling. One way is called stabilizing anneal. Parts are usually heated between 1,500 and 1,600 F, long enough to diffuse chromium into the starved grain boundaries and to coagulate the carbides. Cooling may be slow. The trouble: Corrosion resistance with this treatment is not as good as with solution annealing. ASME allows 1,300 F and higher for stress relieving, cautions against lower temperatures.

### STABILIZED STAINLESS

Columbium, tantalum, and titanium have greater affinity for carbon than chromium. These elements prevent chromium carbides from forming in stainless. Common stabilized grades are Types 347 (Cb) and 321 (Ti). You use stabilized stainless when the part gets hot in use and when it will be exposed to corrosion. These stronger metals sometimes stabilize the weld. The only way to get titanium into the weld, however, is with a gas-shielded arc process. But don't choose Type 347 solely because of welding heat. You can correct sensitized weld by anneal.

Don't expect a columbium-bearing electrode to prevent sensitization in the heat-affected zone of unstabilized base metal. It won't do it because Cb doesn't diffuse into the base metal.

Nor will stabilized stainless steel be entirely free from sensitization. Sometimes you get what is called knifeline attack. If the base metal gets hot enough, Cb, Ta, or Ti carbides dissolve. Then, if the metal is heated to 1,200 F, chrome carbides form at the grain boundaries, and the metal next to the weld is ripe for corrosive attack. The way round this attack is to reheat the metal to 1,600 F. Afterwards, exposure to 1,200 F won't sensitize the base metal. Type 321 is more susceptible to knifeline attack than Type 347 because titanium carbides dissolve at a lower temperature.

### EXTRA-LOW CARBON (ELC) STAINLESS

A newer way to avoid carbides is to use a stainless steel with very low carbon. A limit of 0.03 carbon has enough immunity to carbides to take normal welding or stress relieving without losing corrosion resistance. However, ELC stainless is recommended for use below 800 F.

There are standard specifications covering the ELC stainless steels. AISI designates them with the suffix L and includes Types 304L and 316L in the list of standard steels.

There is nothing to learn in welding the ELC grades. The weld may be an ELC composition or may be stabilized with columbium or titanium, depending on the process. The slightly carburizing flame of oxyacetylene welding makes the use of Type 347 filler rod necessary on ELC base metal. Covered electrodes for metal-arc welding come in Types 308L and 316L, although you may want to use the columbium stabilized counterparts. ELC and columbium- and titanium-stabilized rod or wire are satisfactory for inert arc welding.

You may stress relieve the ELC grades below the usual annealing heats without losing corrosion resistance. Fast cooling isn't necessary; therefore, you avoid stress corrosion.

### WELDING TECHNIQUE

Some think you can avoid carbides in unstabilized, regular-carbon stainless (like 302, 304, and 316) by cooling the weld fast. Our tests prove you can't. We've experimented with various stainless steel thicknesses and grades, welding them with covered stainless steel electrodes. We used standard welding practice. And we fast-cooled the weld with water—in streams behind the crater and in swabs and quenches after welding. Our tests show that you get very little, if any, benefit from rapid cooling.

Some engineers believe thin metal doesn't sensitize because it cools faster than heavy sections. This isn't true. How fast the heat-affected metal cools depends on welding heat input and the amount of metal or other material there is to draw the heat away. Only a small amount of heat is lost to the atmosphere. Thin metals heat more than thick ones and therefore, cool slower.

Sensitizing starts ahead of the arc and is most severe next to the crater. Sensitizing is almost complete an inch behind the crater. The welding process has a lot to do with heating and sensitizing. Slow, low-heat oxyacetylene welding sensitizes stainless the most; electric arc, the least. High speed (mechanized) arc welding is the least likely to precipitate carbides. • •

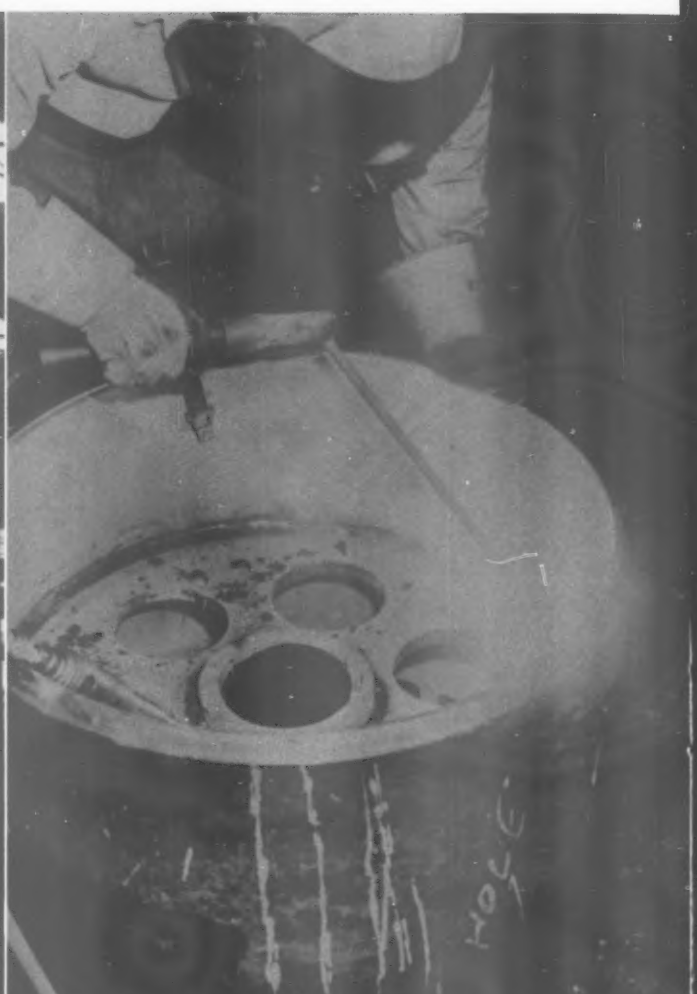


Circle No. 45 on Reader Service Card.⟶

**Jetweld Mild Steel Electrodes** are the fastest electrodes this side of an automatic process. Their high travel speed—made possible by the iron powder in the coating—is literally astonishing. No wonder they're popular. Where do you make best use of them? On jobs welded downhand in flat or horizontal positions. Premium price? No indeed. In fact, their low initial cost will amaze you. See inside how other fabricators have upped their production and cut costs with Lincoln **Jetweld** electrodes.

# THESE ARE LINCOLN
# JETWELD
## MILD STEEL ELECTRODES
## ON THE JOB

**Jetweld 1,** because of its extremely high deposition rate, was the perfect selection for this 120-foot-long expressway bridge plate girder. Finished weld looks as good as one made by submerged arc process. Its soft arc gives slight penetration, virtually no spatter.



By using **Jetweld 2** on this internal circumferential weld, fabricator achieved speeds 50 per cent faster than with conventional mild steel electrodes. High deposition rates are achieved with **Jetweld 2** because of iron-powder content in coating. Welds produced with **Jetweld 2** and **2-HT** are X-ray quality.

There are three Lincoln **Jetweld** electrodes . . . **Jetweld 1, Jetweld 2** and **Jetweld 2-HT**. We call them "fast-fill" electrodes because of their high deposition rates. Management people like this since it means low production costs. But operators like **Jetweld** electrodes, too. Why? Because they're easy to use even by inexperienced weldors and the final weld is as good-looking as one produced by the submerged arc process. However, the **Jetweld** group is limited to operation in the downhand position.

**Jetweld 1** is the original fast-fill electrode. It delivers a soft, virtually spatter-free arc. Because of high deposition rates coupled with a slag that just curls up and flakes away without chipping, production runs with **Jetweld 1** are extremely fast. And costs stay low.

**Jetweld 2** is designed to give especially good physical properties, X-ray quality, and exceptionally high deposition rates. Washes up well in deep groove, avoids undercut. And slag crumbles for easy removal. Only difference between **Jetweld 2** and **Jetweld 2-HT** is that **2-HT** is a ½ moly electrode. With it you get X-ray quality at high speeds on low-alloy, high-tensile steels.

On those jobs where you would like to take advantage of the higher speeds of iron-powder electrodes, but which require some downhill or other out-of-position welding, you can take advantage of still another Lincoln electrode, Improved **Fleetweld 47**. Here's a truly versatile electrode which compromises some of the high **Jetweld 1** speed to gain some of the all-position capability of **Fleetweld 7** . . . particularly in the smaller sizes. Many plants save money by standardizing on this electrode when faced with the problem of getting highest speeds on irregular-shaped parts.

LINCOLN ELECTRODES

We at Lincoln are dedicated to the principle of bringing the best electrode performance to you at lowest possible cost. We are proud to offer the **Jetweld** electrode series to you at prices only slightly above ordinary electrodes for mild steel. Are you taking advantage of this superior performance on your jobs? Why not look into the feasibility of doing so, particularly since you will be able to save money not just in the long run . . . but right now . . . in terms of higher production at lower costs. Why not get all the facts about these and the full line of Lincoln electrodes from your Lincoln field engineer. He's a specialist in welding. No obligation, of course.

Improved **Fleetweld 47** is an iron-powder electrode that combines both high deposition rate and versatility. It is an excellent electrode for production welding of irregular-shaped products such as this engine mount which calls for 45° downhill as well as flat position welding.

**Jetweld 2-HT** is used to make high-speed, X-ray quality welds on high-alloy, high-tensile steels. Here it is used to weld wing plates to a tower base at 15 ipm. Welds are highly stressed in service but none has failed in prolonged use. **Jetweld 2-HT** is easy to use . . . even for inexperienced operators.

# LINCOLN ELECTRODES SELECTION GUIDE

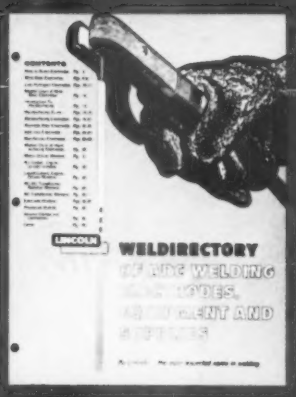
| Electrode | AWS Classification | Color Code | Polarity | Size | Current Range | * Recommended Current Set |
|---|---|---|---|---|---|---|
| **FOR MILD STEEL** | | | | | | |
| **FLEETWELD 5** For all positions, deep penetration. Used for structural, pipe, pressure vessels and applications where X-ray quality welds are required. | E 6010 | White | DC + | 1/8" | 75-140 | 130 |
| | | | | 5/32" | 90-175 | 165 |
| | | | | 3/16" | 140-225 | 210 |
| | | | | 1/4" | 200-315 | 290 |
| | | | | 5/16" | 250-375 | 350 |
| | | | | 3/8" | 310-450 | 400 |
| **FLEETWELD 5 P** For all positions, deep penetration. Similar to Fleetweld 5, but with more penetration and less slag. | E 6010 | Red Brown | DC + | 1/8" | 75-130 | 70 |
| | | | | 5/32" | 90-175 | 110 |
| | | | | 3/16" | 140-210 | 170 |
| **FLEETWELD 7** For general purpose welding of mild, medium carbon, or low alloy steels. Excellent for joints with poor fit-up. | E 6012 | Tan | DC - or AC | 1/8" | 75-140 | 75 |
| | | & White | | 5/32" | 95-185 | 110 |
| | | | | 3/16" | 135-240 | 170 |
| | | | | 1/4" | 210-310 | 240 |
| | | | | 5/16" | 275-390 | 290 |
| | | | | 3/8" | 340-450 | 340 |
| | | | | 7/16" | 375-490 | 390 |
| | | | | 1/2" | 425-550 | 440 |
| **FLEETWELD 7 MP** Similar to Fleetweld 7 but with better deposit wetting and better AC operation. | E 6012 | Brown | DC - or AC | 1/8" | 90-130 | 130 |
| | | & White | | 5/32" | 120-210 | 170 |
| | | | | 3/16" | 160-240 | 210 |
| | | | | 1/4" | 220-310 | 290 |
| | | | | 5/16" | 290-390 | 340 |
| | | | | 3/8" | 350-450 | 390 |
| **FLEETWELD 35** Similar to Fleetweld 5, but for use with reduced AC emission. | E 6011 | White | AC or DC | 1/8" | 70-125 | 90 |
| | | & Blue | | 5/32" | 90-180 | 130 |
| | | | | 3/16" | 130-230 | 170 |
| | | | | 1/4" | 190-300 | 240 |
| | | | | 5/16" | 240-360 | 290 |
| **FLEETWELD 37** Suitable for all positions and types of joints and especially good for high-speed welding of plate or sheet of 1/4" thickness or less in the vertical down position. Excellent AC operation. | E 6013 | Dark Tan | AC or DC | 1/8" | 60-95 | 80 |
| | | & Brown | | 5/32" | 80-140 | 120 |
| | | & Green | | 3/16" | 90-180 | 160 |
| | | | | 1/4" | 140-240 | 210 |
| | | | | 5/16" | 190-300 | 260 |
| **IMPROVED FLEETWELD 47** Versatile iron powder electrode. Suitable for all position welding and especially good for downhill production welding. Excellent AC operation. | E 7014 (E 6014) | Gray Brown & Brown | AC or DC | 1/8" | 110-150 | 140 |
| | | | | 5/32" | 150-210 | 190 |
| | | | | 3/16" | 190-270 | 240 |
| | | | | 1/4" | 260-350 | 310 |
| | | | | 5/16" | 320-420 | 390 |
| | | | | 3/8" | 400-500 | 450 |
| **FLEETWELD 72** For high-speed welding of lap and fillet welds in quiet steel. | E 6012 | Tan | DC - or AC | 1/8" | 95-140 | 120 |
| | | & White | | 5/32" | 125-200 | 180 |
| | | & Green | | 3/16" | 175-275 | 250 |
| | | | | 1/4" | 250-350 | 340 |
| | | | | 5/16" | 295-405 | 425 |
| | | | | 3/8" | 350-450 | 450 |
| **FLEETWELD 180** Permissively good on vertical and overhead welding. Especially designed for use with AC welders having low open circuit voltage. Deep penetrating, almost no slag. | E 6011 | Tan | AC or DC - | 1/8" | 80-90 | 90 |
| | | & Blue | | 5/32" | 90-130 | 130 |
| | | | | 3/16" | 110-190 | 170 |
| **JET-WELD 1** High-speed iron powder electrode for production flat and horizontal fillets. Easy to use, produces beads with excellent appearance. | E 7024 (E 6024) | Dark Gray & Black & Yellow | AC or DC - | 1/8" | 90-110 | 90 |
| | | | | 5/32" | 130-190 | 170 |
| | | | | 3/16" | 190-250 | 250 |
| | | | | 1/4" | 240-320 | 310 |
| | | | | 5/16" | 300-400 | 390 |
| | | | | 3/8" | 380-500 | 450 |
| | | | | 7/16" | 450-620 | 510 |
| | | | | 1/2" | 500-650 | 570 |
| **JET-WELD 2** High-speed iron powder electrode for production flat, deep groove welds and flat and horizontal fillets. Easy to use, produces X-ray quality welds with excellent appearance. | E 6027 | Red Brown & Green | AC or DC - | 1/8" | 180-240 | 210 |
| | | | | 5/32" | 220-310 | 270 |
| | | | | 3/16" | 300-400 | 360 |
| | | | | 1/4" | 360-480 | 450 |
| | | | | 5/16" | 450-600 | 580 |
| | | | | 3/8" | 475-660 | 700 |
| **FOR LOW ALLOY HIGH TENSILE STEELS** | | | | | | |
| **SHIELD-ARC 65** For all position, deep penetration welding of steels of approximately 70,000 to 80,000 psi tensile strength. | E 7018-G | Pink & Blue | DC + | 1/8" | 75-140 | 140 |
| | | | | 5/32" | 110-190 | 190 |
| | | | | 3/16" | 140-220 | 280 |
| | | | | 1/4" | 190-320 | 360 |
| | | | | 5/16" | 250-400 | 450 |
| **SHIELD-ARC 65 P** Especially designed for vertical down cover passes on pipe. Also excellent for fillet and stringer pass in any welding. | E 7018-G | Pink & Blue & Green | DC + | 1/8" | 140-225 | 140 |
| **JET-WELD 1 HT** For arties fast welding of flat, deep groove welds and flat and horizontal fillets on high tensile steels. | E 7028-A1 | Red Brown & Blue & Yellow & White | AC or DC | 1/8" | 190-275 | 190 |
| | | | | 5/32" | 250-350 | 250 |
| | | | | 3/16" | 275-375 | 325 |
| | | | | 1/4" | 350-450 | 390 |
| **JET-WELD LH 70** Low hydrogen, iron powder electrodes for welding ultra high strength steels and other steels that require either the minimum 70,000 psi tensile or chemical 1¼% chrome, ½% moly properties of Jetweld LH 90 deposits. Also meets the requirements of E 8018-GH. | E 7018-G | Gray & Yellow & Blue & Green | DC + or AC | 1/8" | 90-140 | 130 |
| | | | | 5/32" | 130-200 | 180 |
| | | | | 3/16" | 180-280 | 220 |
| | | | * | | | |
| **FLEETWELD 1** For high tensile steels and SAE 4130 and SAE 8630 Chromoly steels such as aircraft parts 1/8" and thicker. Also can be used on mild steels. | E 10013-G | Dark Tan & Green & Brown & Green | DC + or AC | 1/8" | 85-75 | 95 |
| | | | | 5/32" | 90-130 | 110 |
| | | | | 3/16" | 90-180 | 150 |
| | | | | 1/4" | 140-240 | 210 |
| **JET-WELD LH 110** Low hydrogen, iron powder electrodes for welding HY-80, T-1, or other alloy steels that require the physical properties 110,000 psi, tensile, of Jetweld LH 110 deposits. | E 11018-G | Gray & Red & Blue & Green | DC + or AC | 1/8" | 90-130 | 130 |
| | | | | 5/32" | 130-200 | 180 |
| | | | | 3/16" | 180-280 | 220 |
| | | | | 1/4" | 250-360 | 325 |
| | | | | 5/16" | 320-450 | 375 |
| | | | | 3/8" | 370-500 | 450 |
| **FOR HARD-TO-WELD STEELS** | | | | | | |
| **JET-WELD LH 70** An iron powder type low hydrogen electrode for welding cold steel, low alloy, high tensile steels, and for steels of poor weldability. Suitable for all position welding, exacting X-ray quality. | E 7018 (E 6018) | Gray & Black & Orange & Green | DC + or AC | 1/8" | 75-95 | 90 |
| | | | | 5/32" | 95-135 | 130 |
| | | | | 3/16" | 135-200 | 180 |
| | | | | 1/4" | 180-260 | 230 |
| | | | | 5/16" | 240-320 | 290 |
| | | | | 3/8" | 290-380 | 350 |
| | | | | 7/16" | 350-440 | 410 |
| | | | | 1/2" | 375-475 | 450 |
| **JET-WELD LH 71** Arrested LH 70 in quite similar to Jetweld LH 70, may have less notch characteristics. It is produces spool tip fillets, and E 7a entitles it exceptionally resistant to moisture pick-up. | E 7048 (E 6048) | Gray & Black & Orange & Green & Green | AC or DC + | 1/8" | 110-145 | 140 |
| | | | | 5/32" | 140-205 | 190 |
| | | | | 3/16" | 190-280 | 250 |
| | | | | 1/4" | 250-360 | 330 |
| | | | | 5/16" | 300-440 | 420 |

Key to Electrode Color Code Identification

E 5 0 L

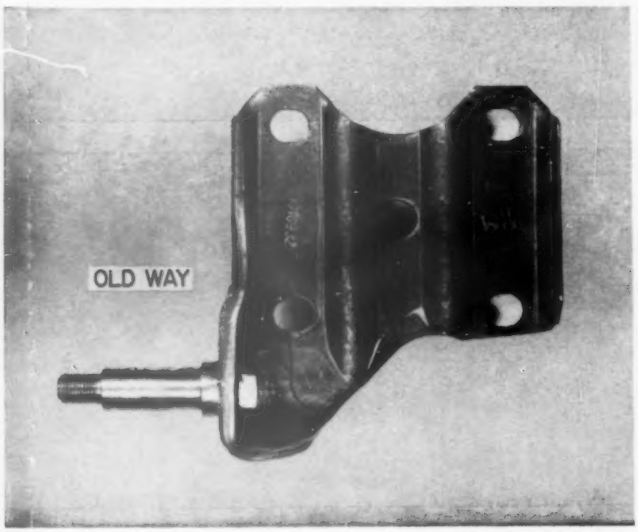
Lincoln Codenum

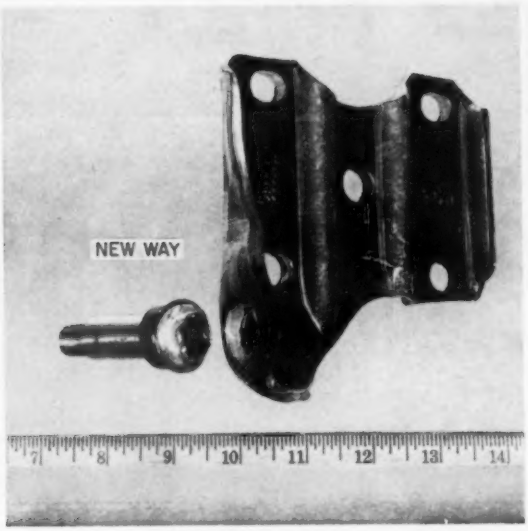
| Electrode | AWS Classification | Color Code | Polarity | Size | Current Range | * Recommended Current Set |
|---|---|---|---|---|---|---|
| **FOR STAINLESS STEELS** | | | | | | |
| **STAINWELD 65** For welding 18% chromium, 8% nickel steels in all positions. Lime type coating. | E 308-15 | Light Green & Yellow & Black | DC + | 1/8" | 70-90 | 80 |
| | | | | 5/32" | 80-125 | 90 |
| | | | | 3/16" | 120-170 | 130 |
| | | | | 1/4" | 170-230 | 180 |
| | | | | 5/16" | 220-290 | 230 |
| | | | | 3/8" | 270-340 | 280 |
| **STAINWELD 65 CB** For welding 18% chromium, 8% nickel steels in all positions Columbium stabilized. Lime type coating. | E 347-15 | Light Green & Red & Yellow & Black | DC + | 1/8" | 70-90 | 80 |
| | | | | 5/32" | 80-125 | 90 |
| | | | | 3/16" | 120-170 | 130 |
| | | | | 1/4" | 170-230 | 180 |
| | | | | 5/16" | 220-290 | 230 |
| | | | | 3/8" | 270-340 | 280 |
| **STAINWELD 67** For welding 18% chromium, 8% nickel steels. Titania type coating. | E 308-16 | Light Gray & Yellow & Blue | DC + or AC | 1/8" | 70-90 | 80 |
| | | | | 5/32" | 80-125 | 90 |
| | | | | 3/16" | 120-170 | 130 |
| | | | | 1/4" | 170-230 | 180 |
| | | | | 5/16" | 220-290 | 230 |
| | | | | 3/8" | 270-340 | 280 |
| **STAINWELD 67 CB** For welding 18% chromium, 8% nickel steel Columbium stabilized. Titania type coating. | E 347-16 | Light Gray & Red & Yellow & Blue | DC + or AC | 1/8" | 70-90 | 80 |
| | | | | 5/32" | 80-125 | 90 |
| | | | | 3/16" | 120-170 | 130 |
| | | | | 1/4" | 170-230 | 180 |
| | | | | 5/16" | 220-290 | 230 |
| | | | | 3/8" | 270-340 | 280 |
| **STAINWELD D.C.B.** For welding 18% chromium, 12% nickel steels. Type 309 in all positions Columbium stabilized. Lime type coating. | E 309-15 | Light Green & Red & Black & Black | DC + | 1/8" | 70-90 | 80 |
| | | | | 5/32" | 80-125 | 90 |
| | | | | 3/16" | 120-170 | 130 |
| | | | | 1/4" | 170-230 | 180 |
| **STAINWELD 1 CB** For welding Type 310 stainless steel, 25% Nickel-chromium in all positions Columbium stabilized. Lime type coating. | E 310-15 | Light Green & Red & Yellow & Black | DC + | 1/8" | 70-90 | 80 |
| | | | | 5/32" | 80-125 | 90 |
| | | | | 3/16" | 120-170 | 130 |
| | | | | 1/4" | 170-230 | 180 |
| **STAINWELD 316** For welding 18% chromium, 12% nickel steels Type 316 in all positions. Lime type coating. | E 316-15 | Light Green & Red & Black | DC + | 1/8" | 70-90 | 80 |
| | | | | 5/32" | 80-125 | 90 |
| | | | | 3/16" | 120-170 | 130 |
| | | | | 1/4" | 170-230 | 180 |
| **FOR HARDSURFACING** | | | | | | |
| **MANJET** Low hydrogen electrode for building up 12-14% manganese steel. Deposits striker shock or blow. Also for securing base groove steel parts or joining manganese steel to carbon steel. | Dark Gray & Orange & Red & Blue | DC + or AC | 1/8" | 125-175 | 200 |
| | | | 5/32" | 170-250 | 250 |
| | | | 3/16" | 250-350 | 350 |
| **MANGANWELD 1** For building up manganese steel with these deposits. | Rust Red & Blue | DC + | 1/8" | 120-150 | 130 |
| | | | 5/32" | 170-220 | 190 |
| **JET-HARD DC 40** Iron powder electrode which produces a medium carbon, medium alloy deposit with a brinell, tough, martensitic surface of moderate hardness to resist shock and abrasion. Excellent for building up unusually worn parts prior to hardfacing. | Gray & Blue | DC + or AC | 1/8" | 140-180 | 170 |
| | | | 5/32" | 180-250 | 250 |
| | | | 3/16" | 225-325 | 325 |
| **B-HARD 600** For surfacing to resist rolling or sliding abrasion. Harder than the Hard 300, 400. | Dark Gray & Blue | DC + | 1/8" | 140-170 | 160 |
| | | | 5/32" | 170-240 | 220 |
| **ABRASOWELD** Versatile electrode for building up brittle carbon, low alloy or high manganese steel with self-hardening deposit to resist impact and severe abrasion. | Black & Blue | DC + or AC | 1/8" | 90-130 | 90 |
| | | | 5/32" | 120-180 | 130 |
| | | | 3/16" | 170-250 | 190 |
| | | | 1/4" | 240-325 | 250 |
| **FACEWELD 1** For surfacing worn shafts and moderate impact. | Rust Tan & Blue | DC + or AC | 1/8" | 90-120 | 90 |
| | | | 5/32" | 130-180 | 130 |
| **FACEWELD 12** For extremely severe abrasion. | Light Tan & Blue & Pink | DC + or AC | 1/8" | 90-120 | 90 |
| | | | 5/32" | 130-180 | 130 |
| **SURFACEWELD** An alloyed powder, applied with carbon arc gas Lincoln Arc Torch with 5/8" or wall-supplied rollers with 180° or 90°. For smooth, thin layer to resist severe abrasion. | Powder & Electrode | Arc Torch 5/8 Carbon 1/4" or AC | 1/8" | 70-90 | 75 |
| | | | 5/32" | 90-110 | 90 |
| | | | 3/16" | 110-130 | 110 |
| | | | 1/4" | 130-150 | 130 |
| | | | used 1/4" | 140-170 | 140 |
| | | | 5/16" | 150-180 | 150 |
| | | | used 1/4" | 190-230 | 190 |
| **TOOLWELD 40** For building up high-speed metal cutting edges on cold rolled steel, or for relieving worn edges on tools and dies. | Black & Blue | DC + | 1/8" | 80-100 | 80 |
| **TOOLWELD A & O** For tool steel steering surfaces to be used in an annealed condition, or hardened by air cooling or oil quenching. | Black & Blue | DC + or AC | 1/8" | 60-80 | 70 |
| | | | 5/32" | 80-120 | 110 |
| **FOR CAST IRON AND NON-FERROUS METALS** | | | | | | |
| **FERROWELD** For shielded arc welding of cast iron where machinability is not required. Deposit is mild steel. | Bare & Orange | Light Tan DC + or AC | 1/8" | 90-130 | 90 |
| **CASTWELD** For welding cast iron where the weld must be machined. Deposit is nickel. | ENi & Orange & Blue & White | Black DC + or AC | 1/8" | 90-120 | 100 |
| | | | 5/32" | 100-130 | 120 |
| **ALUMINWELD 43** For welding aluminum sheets, castings of like kinds. For manifolds, or carbon, etc. Demolished recommended. | 43 & Blue | Peach DC | 1/16" | 20-35 | 30 |
| | | | 1/8" | 40-130 | 100 |
| | | | 5/32" | 80-170 | 130 |
| | | | 3/16" | 120-220 | 170 |
| | | | 1/4" | 170-280 | 220 |
| | | | 5/16" | 220-380 | 280 |
| **LINDEWELD** For welding bronze, brass or copper alloys, alone or cast iron. All positions. | E-Cu96-C & Yellow & Blue & Blue | Peach DC | 1/8" | 80-120 | 100 |
| | | | 5/32" | 90-130 | 120 |
| | | | 3/16" | 120-170 | 150 |



LINCOLN ...USA

# Projection welded part absorbs shocks better, longer




**FATIGUE TESTS,** tougher than road tests, tell how automotive parts will hold up—in a hurry. The whole corner of the bolted shock-absorber spring-plate assembly (left) cracked. The projection welded stud assembly (right) broke in the plate too, but after hundreds of thousands more test cycles.

**IN BRIEF: A switch to projection welding improved Chrysler rides, made an important part last longer, and reduced its manufacturing costs.**

AUTOMOBILES RIDE SMOOTH on rough roads. Springs and shocks absorb road punishment. But if passengers are spared jars and wrenches, there's one assembly, the one that holds the springs and shock absorbers, that isn't spared anything. It's called the shock-absorber stud-spring-plate assembly. It consists of a formed plate with U-bolt holes and a stud to hold the shock absorber.

Before 1959, Chrysler fastened the shock absorber bolt to the spring plate with a nut. The bolt was a 3½-inch-long screw machine part with 11/16-inch diameter shank and a ⅞-inch-diameter shoulder. It required an expensive locknut. The bolt was expensive to make and assemble, and every passenger car had two of them.

Chrysler wanted a smoother ride; it wanted a longer-lasting plate assembly; it wanted to make the assembly faster and cheaper. Its Metal Joining Lab found the way: Projection welding.

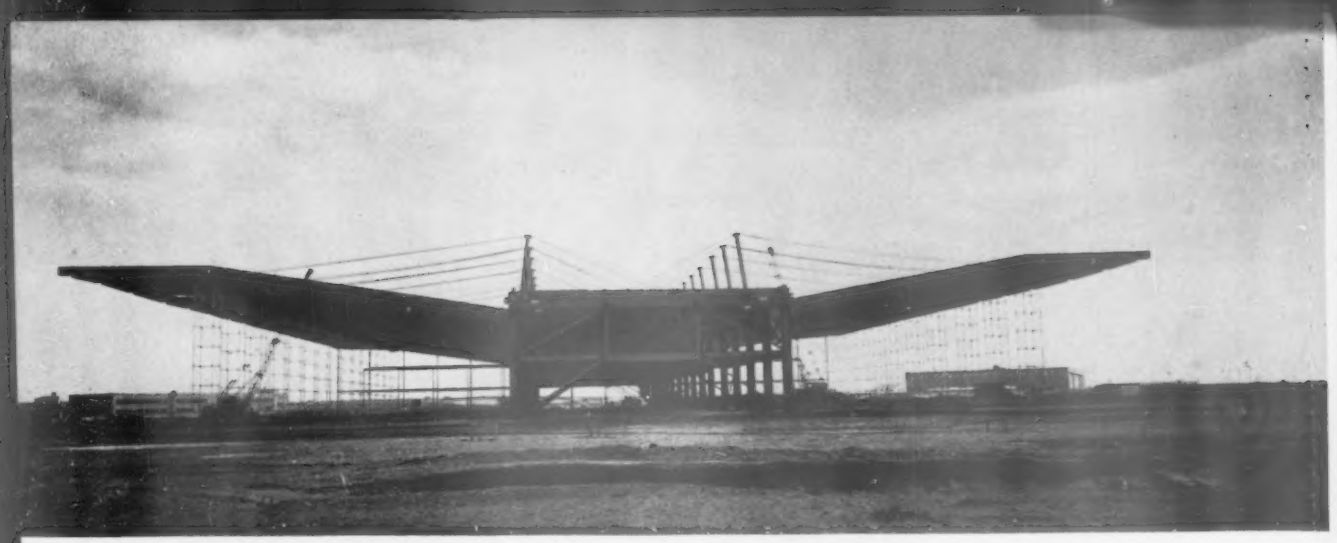
The new design, standard on every Chrysler car, is better than the nut-and-bolt assembly in every way. It's substantially cheaper (there's one on each side), stronger, faster assembled, takes less space and, if you like, looks better. The cold-formed stud is shorter than the bolt by an inch. Unlike the bolt, it becomes an integral part of the plate through the full-circle projection weld.

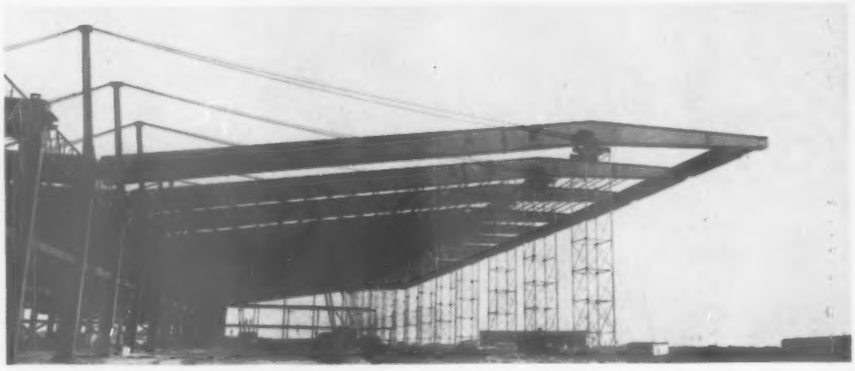
The stud has a conical head whose nose pilots into a ⅝-inch hole in the plate. The stud head also tapers into the shank for strength.

During welding, the hole edges are the projection. As resistance heats hole edges and stud head, the welder forces the stud through until the full thickness of the plate is welded. Chrysler uses a 300-kva transformer and 40,000 amps current, either on pulsation welding or straight (60 cycle) weld time. Welding force is 4,000 pounds.

Before the stud replaced the bolt on Chrysler cars, it had to be proved better. Engineers ran fatigue tests that were far tougher than any road test. These tests amounted to at least 50,000 miles of hard driving on the worst roads. The bolt didn't break, but a whole corner of the formed plate failed on fatigue. Welded studs took some plate with them too on fatigue, but after hundreds of thousands of cycles more than the bolted assembly. Put another way, this means thousands of miles of trouble-free, bump-free driving. • •

←—Circle No. 45 on Reader Service Card.





**NOT A JET** touching down—it's a hangar with cable-suspended, gull-wing girders that measure 400 feet, tip-to-tip. Closeup shows temporary, 46-foot-high jacking towers used to align the girders before cables were installed. Jets will nose-in to columns for service.

**by OMER W. BLODGETT,**
*design consultant,*
*Lincoln Electric Co.*

*How do you support 158-foot roofs without columns or cantilever trusses?*

# Welded girders solve design dilemma

**IN BRIEF: The strength, rigidity, and lightness of welded box-section girders made it possible to have wing-like roofs suspended from cable.**

BIG JET AIR LINERS, with 150-foot wing spreads, are changing the design of hangars. The airport people want to service the big ships under a roof, but they don't want columns blocking the way.

The Port of New York Authority designed, and is building, a new hangar that fills the bill. Fittingly enough, the building looks like a giant jet. It has a cable-suspended, double-cantilever roof extending 158 feet on each side of an 84-foot-wide structural frame.

The roof consists of 16 welded box girders that spread like the wings of a sea gull. They're 400 feet, tip-to-tip. Depth of the building is more than 500 feet. This design provides wide-open areas that will house three nosed-in jets on either side of the building.

The hangar has a 2-story, welded structural steel frame. The 7-degree-inclined roof girders connect to the frame with big hinges—plates welded to girder webs and 7-inch pins. The 5-foot-deep by 3-foot-wide girders (same size as the frame girders) extend 107 feet to the beginning of the tapered tips. The tips taper to a depth of 3 feet at the end.

The girder webs, 4 inches in from flange edges, are welded outside with continuous $\frac{3}{8}$-inch fillets. The Port people designed the girders for field splicing to simplify shipping and erection.

Girder webs are of $\frac{1}{2}$-inch plate—except at their tapered ends. The tapered ends have $\frac{3}{8}$-inch webs. Flanges vary in thickness from $\frac{3}{8}$ inch to $2\frac{1}{4}$ inches (at cable anchors). Claymont Iron Works, the Claymont, Delaware fabricator, offset flange and web butt-weld splices at least three feet.

Every 17 feet, Claymont strengthened the girders with cross frames made of $2\frac{1}{2}$ by $2\frac{1}{2}$ angles. They fillet welded frame vertical angles to web plates. They also welded T's along girder webs with $\frac{1}{4}$-inch fillets.

### CABLES RIDE WELDED SADDLES

Cable masts are 26-foot-high, tapered I-beams. The masts, crowned with welded steel saddles, hinge at the frame girder flange just back of the big hinge pins and directly over the building columns. The masts lean inward 7 degrees and bisect the angles of the suspending cables. Claymont welded cable anchoring plates to each side of the girders, where they begin to taper. Button-end sockets anchor the cables, and can be taken up slightly at the tip end by shims and screw adjustment. In-board anchors are on the frame girders, about 11 feet from the opposite side of the frame. The cables not only support the gull-wing roof, they partially support the second floor of the building's center section.

The 190-foot-long prestretched, galvanized bridge strand cables have a working stress of 80,000 psi. The cable sockets, by the way, must develop the full ultimate tensile strength of the cable (220,000 psi). The building will have 126 cables: three to support end girders, four for the rest. Each cable set has five vibration dampeners made from fillet welded back-to-back angles with U-bolts to hold the cables. The dampeners are of different lengths and spacing to suit the cable spacing at different points.

### JACKING TOWERS RAISE THE ROOF

Fabricating the gull-wing girders was one thing; erecting them was another. The girders had to be held in place accurately while the cables were being strung. The erector did it with 46-foot-high jacking towers placed where the girders begin to taper. He leveled the towers, made of welded scaffold tubing, before he raised the girders.

With the girders in place, the erector tied them together by welding roofing joists to them every 8 feet. Open-web trusses tie the structure together at the columns. Diagonal braces welded between columns further strengthened the frame. The frame takes the direct stress of the roof cantilevers and anchors the cables. • •

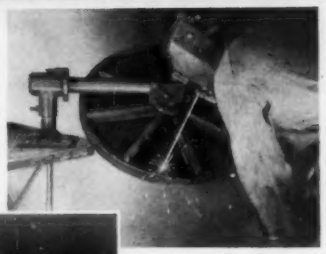
### WHY THE HANGAR WASN'T BUILT ANOTHER WAY

Instead of using cable-suspended girders, the designer could have achieved almost the same effect with double-cantilever-through trusses, Here's why he didn't:

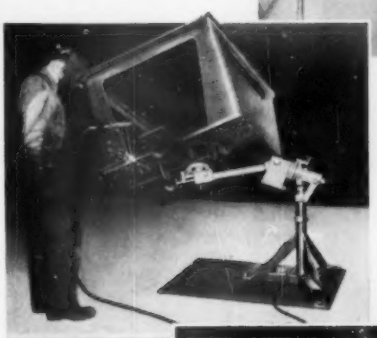
- Center section girders would have had to be very deep to offset the great length and weight of the overhung roofs; a lot of building space would have been lost.

- Full cantilevered trusses would have cost much more than cable-suspended girders. The estimated cost of the suspended roof is $4.50 a square foot. The through-truss cantilever would have cost $7.50 a square foot.


PROFITS are built on DEPENDABILITY



360° Table tilt allows welding on both sides of workpiece without re-clamping when you use this Aronson Bench Turntable.



Heavy bulky pieces become childs-play when balanced on an Aronson Universal Balance positioner.

Heavy Duty Gear Driven Positioner showing weldor making good use of Aronson Flat Top Design.

"Positioned" welding is much faster while the quality and appearance of the welds is superior to that of manually positioned workpieces. But to realize its profitable advantages, the positioner must give dependable service over the long haul. Aronson Positioners and Turning Rolls lead all others in long life, ruggedness, precision and dependability.

**Your profits are built on dependability and dependability is our middle name.**

**ARONSON BUILDS THE MOST COMPLETE LINE OF POSITIONERS ...WITH CAPACITIES RANGING FROM 25 POUNDS TO 600 TONS**

**Universal Balance® Positioners • Bench Turntable Positioners**
**Gear Driven Positioners • Headstock-Tailstock Positioners**
**TracTred® Turning Rolls • Turntables • Fully Automatic Positioners**
**Geared Elevation Positioners • Magnetic Welding Clamps**

*Write for detailed engineering data*

**Aronson MACHINE CO., INC.**
**ARCADE, NEW YORK**

**For More Information Circle No. 2 on Reader Service Card.**

# HOW TO SOLVE WEAR PROBLEMS *with CONFIDENCE*

Most problems of equipment wear are complicated by several wear factors, such as impact, abrasion, heat and corrosion. Choosing the best alloy for any set of conditions requires long experience plus an adequate selection of materials. Here's why STOODY, pioneers in hard-facing, gives you more for your hard-facing dollar and eliminates costly experimentation.

- **STOODY** is the only manufacturer that makes a complete line of hard-facing and build-up materials for manual, semi-automatic and fully automatic application.
- **STOODY ALLOYS** are time-tried cost savers; eliminate the need for frequent replacement parts, reduce plant downtime and keep all wearing parts operating at peak efficiency.
- **STOODY APPLICATION PROCEDURES** are the accumulative results of constant testing on the job. Proven procedures are carefully illustrated step by step and published for your use, making duplication easy.
- **STOODY** backs up its entire product line with over 40 year's specialization in the hard-facing industry. No other hard-facing manufacturer can offer equal experience.
- **STOODY** maintains a staff of qualified field engineers ready to help you solve wear problems on your own equipment in your own plant. Their knowledge is yours for the asking.
- **STOODY ALLOYS** are readily available everywhere. Over 750 STOODY dealers serve all parts of the United States as well as industrial centers of Canada and Mexico.

With *more* hard-facing alloys, *more years* of experience, *ready product availability* in all locations and a working staff of *trained field engineers* covering the nation, STOODY serves *all* your hard-facing needs faster, more specifically and with greater satisfaction.

*LITERATURE AVAILABLE ON THE FOLLOWING STOODY ALLOYS...*

### AUTOMATIC and SEMI-AUTOMATIC WIRES

| | |
|---|---|
| STOODY 100 | STOODY 107 |
| STOODY 100 HC | STOODY 108 |
| STOODY 102 | STOODY 110 |
| STOODY 103 | STOODY 115 |
| STOODY 104 | STOODY 121 |
| STOODY 105 | STOODY 130 |
| STOODY 106 | STOODY 134 |

STOODY NICKEL MANGANESE

### MANUAL RODS AND ELECTRODES

| | |
|---|---|
| STOODY BUILD-UP | TUBE STOODITE |
| STOODY NICKEL MANGANESE | STOODITE |
| STOODY 2110 | STOODY 2134 |
| STOODY 1105 | STOODY 6 |
| STOODY 1027 | STOODY 1 |
| STOODY SELF-HARDENING | BOROD |
| STOODY 1030 | TUBE BORIUM |
| STOODY 21 | TUBE BORIUM 30-Down Screen Size |
| COATED TUBE STOODITE | TUBE BORIUM "G" |

### MISCELLANEOUS

STOODITE PLOW POINT BARS
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COBALT BORIUM INSERTS
BORIUM BLAST CLEANING NOZZLES
NOZZLE HOLDERS AND PARTS

### HOW TO GET PERSONAL HARD-FACING HELP

Call your Stoody Dealer (check the yellow pages of your phone book). He will arrange for a visit from your nearest Stoody Field Engineer—or write to the factory.

## STOODY COMPANY

11982 E. Slauson Avenue
Whittier, California

**For More Information Circle No. 60 on Reader Service Card.**

# Hardsurfaced OEM parts and products: A big market getting bigger

**INLET BELL** for a catalytic piping system is surfaced to protect it from erosion from high-velocity aluminum silicate particles. Semi-automatic welding and 340 pounds of alloy did the job: no extra heat was required. See story on page 52.

**IN BRIEF: OEM surfacing may mean a little more first cost, or it may mean less if you can use less-costly base metals. In either case, long-haul cost is a lot less because parts last.**

THERE'S NO QUESTION but what hardsurfacing is valuable for reclaiming worn, eroded, or otherwise spent parts. This way of putting new life into old parts is standard in every industry. More companies in mining, road building, chemical processing, petroleum, and metal fabrication, are learning the economy of a new life for an old part—at a fraction of the cost of a new one.

Besides having restorative powers, hardsurfacing is valuable for making OEM (original equipment manufacture) parts and products last. The number of equipment manufacturers making hardsurfacing a production step is impressive; and the number is growing every year.

It's sensible. Why, if a part can be reclaimed by hardsurfacing when it's worn, shouldn't it be protected when it's new? It isn't sensible that the first life of a part should be a lot less than the second . . . or the third.

Look at the range of new products that are being surfaced now (see list on next page). It's impressive but a lot of other products can be added. Perhaps yours is one of them.

## REASONS FOR GROWTH

Why are more and more OEM people hardsurfacing? First, progressive companies continually try to improve their products. Second: Competition.

When competition is fierce (and hasn't it been?) users demand longer-lasting equipment. In the face of generally rising prices the user must keep overhead down. Smaller maintenance bills through longer-working parts is a good way.

Demands for better products, longer life, and lower prices have made equipment and part manufacturers improve their products and manufacturing techniques. They've redesigned equipment to make it withstand heavier loads, greater speeds, more heat. Many of these designs wouldn't be possible, or practical, without hardsurfacing.

Better products are needed for chemicals; valves, for example, control hotter, more-corrosive materials. It's true in aircraft and missiles: speed makes heat and heat speeds wear. It's true in steel: blast furnace pressures and abrasive sinters would make short work of bells and hoppers without hardsurfacing. Hard working rod mills depend on hardsurfaced rolls and guides to keep them producing. It's true that the rolls and guides can be cast in wear-resisting alloy, but

*text continued on next page*

## PARTIAL LIST OF SURFACED OEM PARTS AND PRODUCTS

- Aircraft Parts
- Arbors
- Asphalt Mixer Paddles
- Baffle Plates
- Blast Furnace Bells and Hoppers
- Bulldozer Blades
- Catalyst Piping
- Cutting Tools
- Cams
- Cam Actuators
- Cylinders
- Crane Shoes
- Couplers
- Coal Cutting Bits
- Cane Knives
- Drill Collars
- Dredge Pump Impellers
- Exhaust Valves
- Forming Dies
- Hot Trimming Dies
- Hammers
- Ladle Pins
- Machine Guides
- Missile Parts
- Mill Rolls
- Mixer Blades
- Ore Screens
- Pumps
- Plastic Extrusion Screws
- Pistons
- Plow Shares
- Pugmill Knives
- Rock Bits
- Reamers
- Rod Mill Rolls and Guides
- Rocker Arms
- Rocket Parts
- Speedmuller Blades
- Sand Blowers
- Shovel Points
- Scraper Blades
- Shear Blades
- Shredder Knives
- Tool Bits
- Tool Joints
- Tong Bits
- Valves
- Wire Straightening Rolls

with hardsurfacing available this is an extravagance.

### MANY DESIGN ADVANTAGES

Hardsurfacing often permits the use of low-cost base metal for OEM parts, protecting only critical wear points. Steel is economical and is also a good base for hardsurfacing alloys. Very often the savings in base materials more than make up for the added cost of hardsurfacing.

### DESIGNER, MANUFACTURING ENGINEER: KEY ROLES

If you are a designer or manufacturing engineer for an OEM company, you have a golden opportunity of improving your company's products (often at a saving) with hardsurfacing. A well-placed deposit of wear-, corrosion-, or heat-resistant alloy could advertise your worth to the company for some time. If you design, you get first crack at it. If you engineer, you can request a manufacturing change to include hardsurfacing. In either case, the more you know about hardsurfacing, the better. If you need help, alloy and welding people will give you all you need.

### ARE THERE OBSTACLES?

There are a few obstacles to the growth of OEM hardsurfacing, but they can be solved. One: Hardsurfacing means an extra operation with expensive materials. This cost must be passed on to customer. Fortunately, there are several factors which can offset the extra cost—and sometimes even reduce the price of the equipment:

- Possible use of lower-cost base metal
- Use of high production automatic or semiautomatic hardsurfacing equipment
- Lower total cost of hardsurfacing through wise choice of alloy and process

Many progressive OEM companies hardsurface even if it means raising prices slightly. The customer benefits; the machine will cost less in the long run. The manufacturer benefits; he has a sales advantage over competitors who do not hardsurface.

Then there are original equipment people who enjoy a profitable replacement parts business. It's hard for them to give this up by improving their products with hardsurfacing. But such companies have an obligation to make the best products possible for the price. If they don't, competitors who have a reputation for lasting products will cut into their business.

Another stumbling block is ignorance of the causes of wear, corrosion, erosion, and other damage, and the variety of conditions that cause this damage. The only solution is education. Designers and engineers must be taught the advantages of hardsurfacing and told of the processes and alloys that are available. This education ought to include testing—to make sure an overlay does its job, but no more.

### EXPERTS CAN GET YOU STARTED

Suppose you are an equipment manufacturer who recognizes the value of hardsurfacing. You want to get started but lack the equipment or the knowhow. To save time and money—call an expert. He may represent an alloy manufacturer, machine manufacturer, or a company doing job hardsurfacing. Which one you call depends on how soon you need parts.

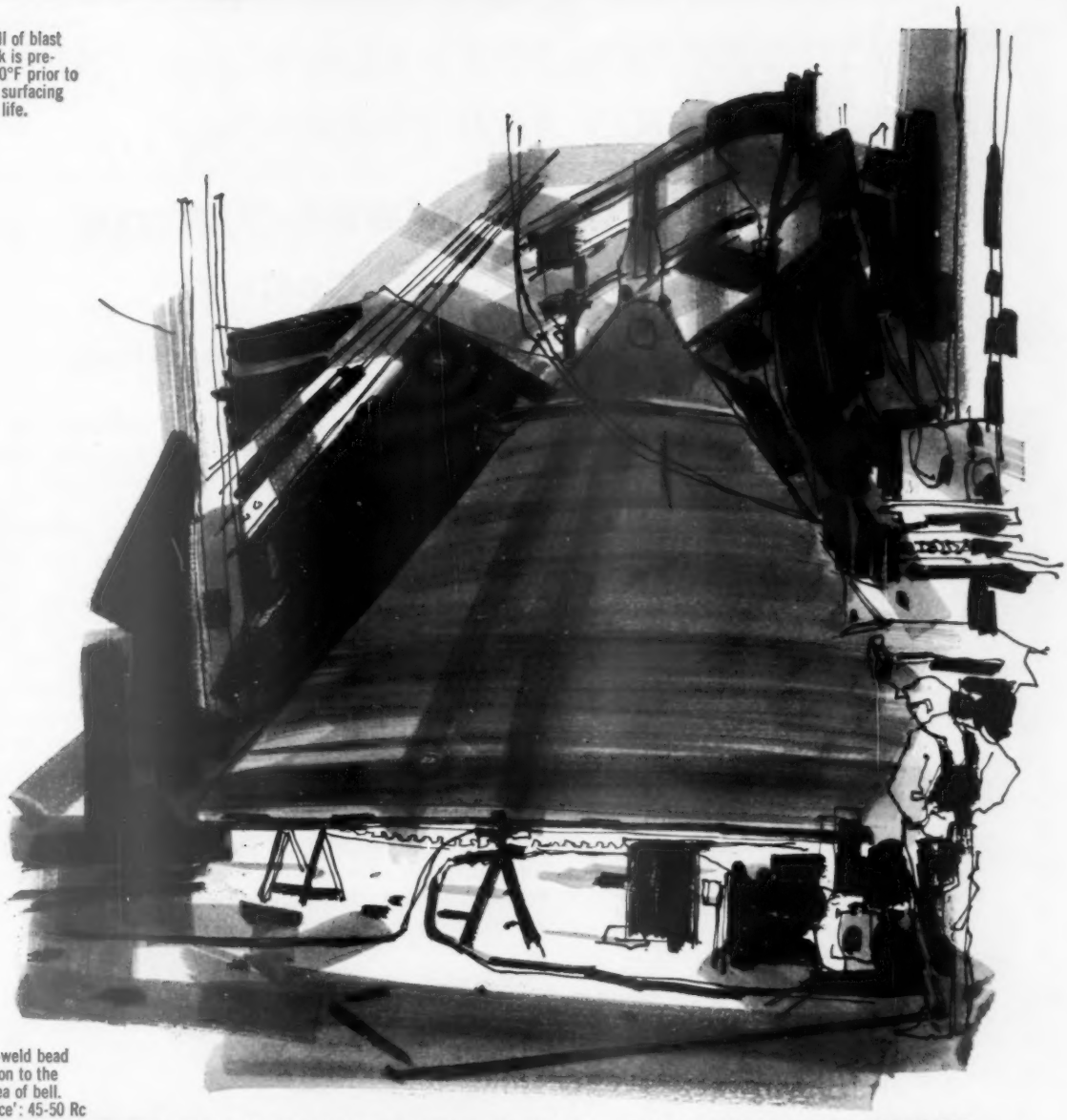
### DEVELOPMENTS

Because OEM hardsurfacing is growing, you can count on some unusual developments. These developments, of course, will also be applicable to reclaiming. Greater use will be made of automatic and semiautomatic hardsurfacing processes. Equipment manufacturers will make hardsurfacing as much an in-line process as welding and fabricating are now. Your OEM hardsurfacing cost will depend on how closely you work with the alloy and welding equipment people. They can steer you to a wise choice of alloy or process that will save you headaches.

No matter what your wear or corrosion problem, there's an alloy and a process that will solve it. • •

*turn to page 48*
*for OEM case histories*

■ Giant bell of blast furnace stack is pre-heated to 400°F prior to Mahon hard surfacing for renewed life.



■ A hard-weld bead is spiraled on to the working area of bell. 'New Surface': 45-50 Rc

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BUY **"fabrication by Mahon"**

Mahon's Steel-Weld Division constantly strives for better fabrication techniques—solidly developed out of long experience combined with broad-range facilities and wide-breadth capacity. ***Example: new hard-coat (to 45-50 Rc) resurfacing*** of worn steel parts for extended useful life. The Mahon method involves special submerged-arc welding, vertical milling and finish grinding. It is as applicable to high-wear new parts as it is to reconditioning older pieces. Why not look into how Mahon 'hard-surfacing' can be profitably used in the products you make or the equipment you use? We suggest you write to Mr. J. W. Ault, Manager of Mahon's Steel-Weld Division.

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# MAHON

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*FOR HIGH TEMPERATURE SERVICE INVOLVING IMPACT, ABRASION AND CORROSION...*

# Wear-Arc & Wear-Flame

## CoCr-A, CoCr-B, CoCr-C

### Cobalt—Chromium—Tungsten Hard Surfacing Alloys

*Wear-Arc & Wear-Flame CoCr alloys are ideally suited for applications such as high pressure steam valves and seats, mill guides, hot shear blades, bearing surfaces, brake drums, engine cams, coke pusher shoes, automotive and diesel engine valves, conveyor screws or any application where high temperature is combined with abrasion, corrosion and impact wear.*

Abrasion, corrosion and impact at temperatures above 1000°F. demands ultimate service from a hard surfacing alloy. Wear-Arc and Wear-Flame cobalt-chromium-tungsten alloys are designed in alloy content and balance to resist these destructive forces—protecting parts made from ordinary steels with heat resisting, abrasion resisting, impact resisting overlays greatly extending service life.

Three Wear-Arc and Wear-Flame cobalt-chromium-tungsten alloys allow proper selection to match wear protection to the wear factors involved. They are products of the electric induction melting process, insuring maximum uniformity of alloy content. The cast core wire is centerless ground to insure accurate wire diameters. Each alloy is available in Wear-Arc coated electrodes for electric arc application or bare rods in 14″ or 6′ lengths for gas application. Wear-Arc electrodes have extruded coatings which produce arc characteristics that cannot be matched by dip coated electrodes.

For additional information concerning specific application methods, procedures and alloy selection, write Alloy Rods Co., P. O. Box 1828, York 1, Pennsylvania.

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**YORK, PENNSYLVANIA**

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**TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES**

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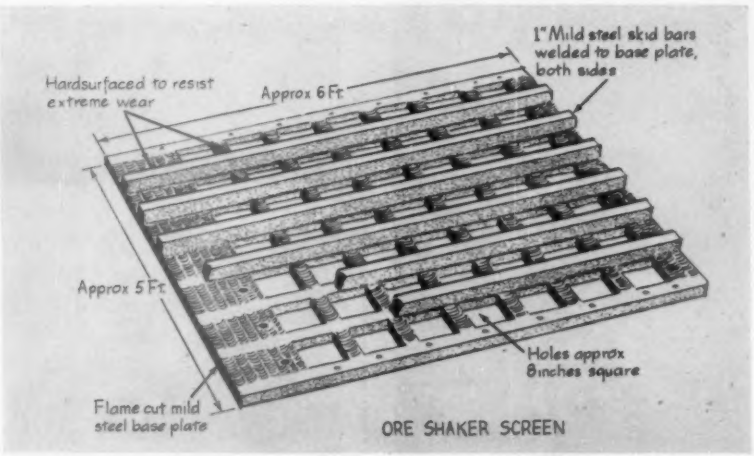
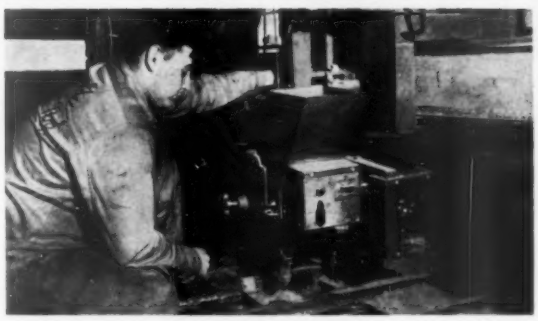
# Creative applications of OEM hardsurfacing

*Here is a sampling of what's being done in OEM hard-surfacing. Each application shows progressive thinking by the manufacturer. Hardsurfacing makes his product better, more-lasting. When it's time to reorder, the customer will remember.*


1" Mild steel skid bars welded to base plate, both sides
Hardsurfaced to resist extreme wear
Approx 6 Ft
Approx 5 Ft
Holes approx 8 inches square
Flame cut mild steel base plate

ORE SHAKER SCREEN



**WELDING HEAD** wiggles over ore screen base plate to make full-width welds in-between skid bars.

## HARDSURFACING REPLACES EXPENSIVE STEEL

STAMFORD, CONNECTICUT: Hewitt-Robbins, Inc., makers of construction and heavy machinery, switched from manganese steel to hardsurfaced mild steel for shaker screens—used at mines to separate ore from rock. The new design works better, but costs less, than the old.

The company flame cuts a typical screen from 1-inch plate (see sketch). Then an operator welds mild steel ribs (called skid bars) to the base plate. Finally, he hardsurfaces the top surface of the in-between base plate. Chunks of ore grind these surfaces as they vibrate down the screen.

H-R uses a Lincoln Electric automatic submerged arc welder equipped with an oscillating attachment to surface. The operator deposits a 5/16-inch-thick layer of medium, semi-austenitic metal on the base plate. He welds at 425 amps, 32 volts with 5/32-inch mild steel wire and alloy flux at 10 ipm. The flux alloys the deposit.

Another advantage of the design: It can be hardsurfaced again when it wears.

*more case histories follow*

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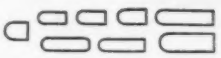

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Coast No. 196 W { (45 55 RC, as deposited) / (Work hardens to 55-60 RC)

Designed to save you time and effort in hard facing, these are the forerunners of an entire line of improved Coast Metals rods.

Their new extruded coatings—result of more than two years of research—provide extremely high deposit rates and make for real ease of welding under all conditions. You can strike the arc readily—hold a long or short arc, as the job demands—position weld with perfect ease. Beads build up nicely, too, and are clean and smooth—require less finishing.

Use Coast No. 192 W for such work as surfacing crushing and grinding machinery, where abrasion is severe.

Use Coast No. 196 W for resistance to both abrasion and impact in overlaying large areas, for example, on earth moving, dredging and mining equipment.

*Write for complete information.*

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**Coast Metals Canada (Ltd.), Hamilton, Ont.**

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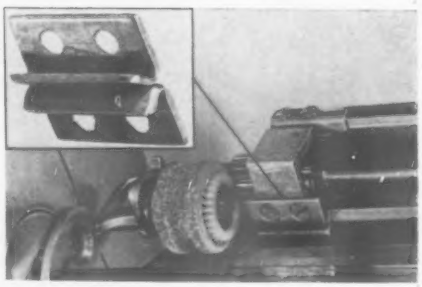
## OEM HARDSURFACING

*continued from page*



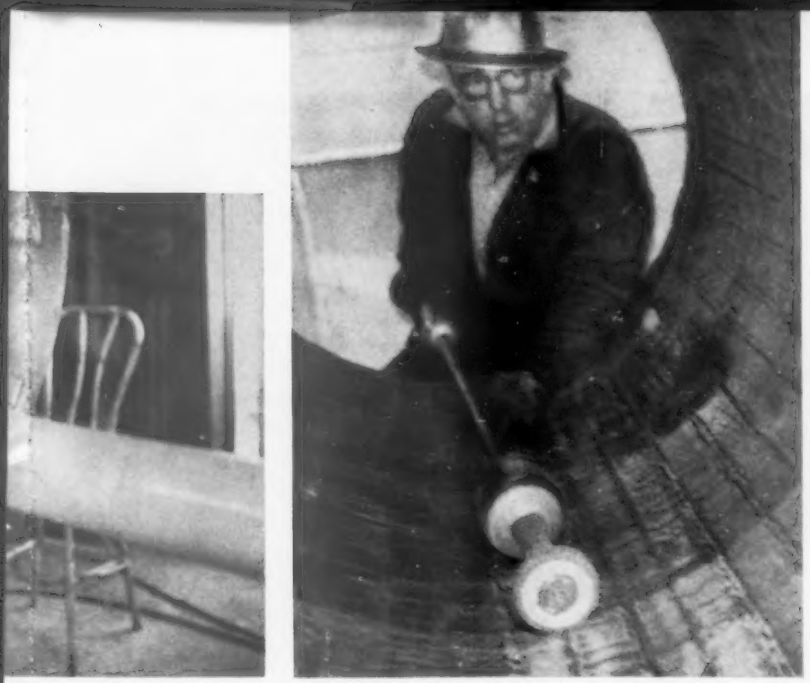
## TUNGSTEN CARBIDE MAKES MACHINE GUIDES LAST

NEW YORK, N. Y.: A little tungsten carbide on H. Maimin Company cloth cutting machines guides has made them last six times longer.

The machine is used to cut lays of cloth and other materials, as thick as 9 inches. An automatic sharpener on the machine keeps the blade sharp.

Two emery wheels on either side of the blade do the sharpening. When working, the wheels travel down and up against the oscillating knife edge, then retract. Sharpening takes two seconds. Two guides, called presser foot stops, keep the wheels aligned with the knife edge. And though tool steel, stops lasted only two months.

But since Maimin has had Linde Company flame plate the stops with 0.0015 inches of tungsten carbide, they last a year. In other words, they last six times longer at only twice the price. In flame-plating, very fine, molten particles of tungsten carbide strike the work at supersonic speeds.



## REFINERY FIGHTS EROSION WITH HARDSURFACING

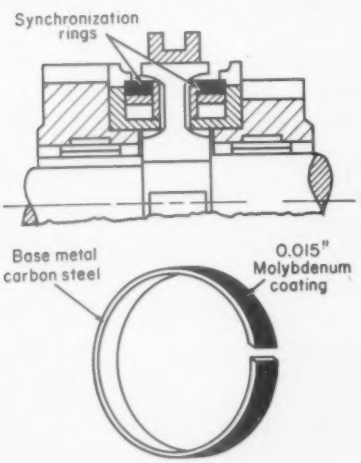
CLEVELAND: Erosion can ruin a catalytic cracking unit. It did the top 50 feet of a 200-foot lift line at Standard Oil's No. 1 Refinery here. Wore paper-thin in a few months. It happens because millions of tiny catalyst particles rub and gnaw until the pipe or vessel fails. So the company decided to protect the new line with hardsurfacing.

Standard's welding people decided on open-arc automatic hardsurfacing because there was so much surfacing to do. They chose 32% chrome, 6½% carbon wire because its deposit resists abrasion at high temperatures. Lift pipes often get hotter than 1,000 F. The deposit contains about 21% chrome, 5% carbon.

To make lift pipes, workers roll ¾-inch ASTM 285 Grade C boiler plate into 6-foot by 34-inch diameter (average) tapered sections. After the operator welds the seam, he surfaces the inside. He makes 3-inch-wide, ⅛-inch thick passes, working in different parts of the pipe to distribute heat. After each pass, he turns the pipe 180 degrees before making the next. This keeps pipes true.

Finally, grinding. There can be no rough spots higher or deeper than 3/32 inch. They would break up the catalyst.

## SPRINGY RINGS FOR SPORTS CARS




GERMANY: Sports cars made by Porsche have springy carbon steel transmission synchronization rings because they are flame sprayed with a 0.015-inch coating of molybdenum.

In coating, Porsche puts 10 to 50 rings, separated by slightly smaller copper spacer rings, on a mandrel and blasts them with fine aluminum oxide. They preheat the rings to 200F and metallize. They use a Metco, Inc. gun and pure molybdenum wire.

Result: a fine-particle coating that requires no other finishing. Now other European car manufacturers are doing the same thing.

*more case histories follow*

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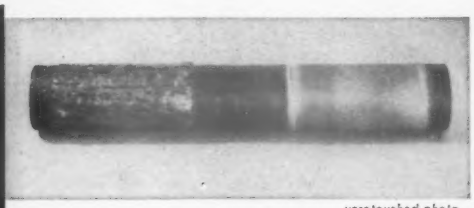
# How flame spraying can pay for itself in your shop in a very short time

**ONE EXAMPLE**
Hard facing time cut from 4 hours to 25 minutes



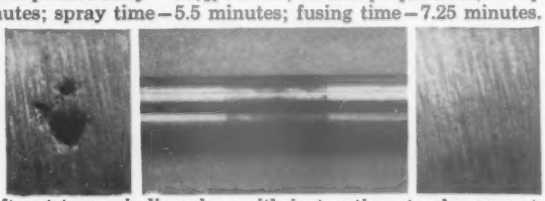
unretouched photo

**The two end sections of this shaft have been built up with AMS 4775. Section at left applied by welding – time 4 hours; section at right by flame spraying – time 24 minutes, 45 seconds.**

**QUESTION: Look at the picture. Which end would you prefer to grind finish?**

Here's the whole story. We took a 15" length of 2.5" mild steel shafting and undercut two 5" sections .050" on the radius. We then sent the shaft to a nationally-known job shop with instructions to apply AMS 4775 on the left-hand section, sufficient to finish at 2.5". Weight of welded-on alloy was 17 9/16 ounces – time spent by one of their top men – 4 hours (including preparation).

Then we blasted the second section with steel grit and flame sprayed it with AMS 4775 in powder form (ThermoSpray Powder 15E). The coating was then torch-fused. Weight of deposited alloy – 11 5/16 ounces; surface preparation, set-up and pre-heat – 12 minutes; spray time – 5.5 minutes; fusing time – 7.25 minutes.



**Unretouched photo, in center, shows finish-ground shaft. Insets, magnified about 50X, show pits in welded section (left) and no pits in flame sprayed section at right.**

We then sent the shaft out to a grinding shop with instructions to clean up at 2.500" plus. The flame-sprayed section cleaned up at 2.510" but welded section still showed pits when grinding was stopped at 2.477" Rockwell of welded end Rc-61, sprayed end Rc-60.

**Pump plunger being flame sprayed with METCO ThermoSpray® Powder Gun**

These flame-sprayed coatings are solid, homogeneous; usually superior to those applied by other methods. You can apply them at high speed, with lower material and finishing costs. In addition to AMS 4775, a number of other powders – including tungsten carbides – are available for various service requirements; all may be fused–some used as sprayed for certain service requirements.

**For further information on this high-speed, money-saving, hard-facing process, phone, write or wire.**

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**For More Information Circle No. 50 on Reader Service Card.**


## OEM HARDSURFACING

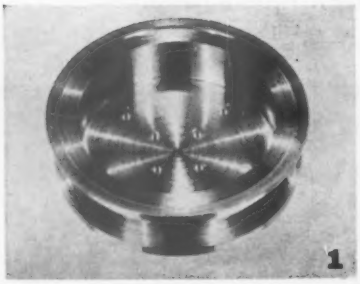
*continued from page 51*

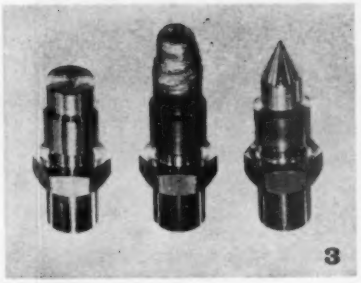
### THE ONE WAY TO PROTECT REFINERY PIPING

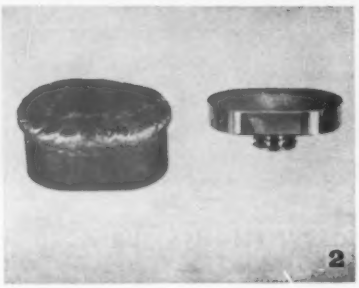
American Alloy Corporation, Cleveland, is no stranger to OEM hardsurfacing. Among the many jobs it has done are refinery catalytic piping systems, surfaced inside to resist high temperature erosion. The inlet bell part of this system (see page 45) operates at about 1,050 F.

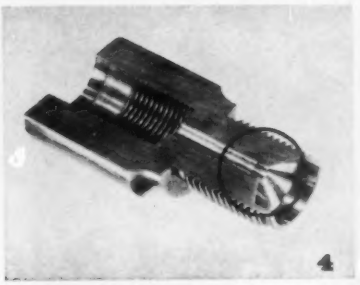
Catalyst piping must be surfaced to keep the high-velocity catalyst (aluminum silicate) from wearing away piping walls. It would do this in a few months if the parts were not protected. And surfacing is the only practical way to provide this protection. What about carbide castings? They don't come large enough, and even if they did, they'd cost too much and be too fragile.

American surfaces bells with semi-automatic welding and 7/64-inch alloy wire. The deposit chemistry is right to resist hot erosion. The deposit relieves its own stresses by craze-cracking. Craze-cracking doesn't impair the effectiveness of the deposit but does prevent stresses from distorting the bell. The welding operator uses low amperage (250) in welding to limit penetration into the cast steel base metal and keep the bell cool. The job takes 37 hours and 340 pounds of alloy. No preheat or postheat is necessary.




## HARDSURFACED VALVE AND PUMP PARTS

"We hardsurface original equipment parts for many companies," says John Szereto, president of Cleveland Hard Facing, "and we've faced some unusual ones. The key to wear, heat, and corrosion, we find, is properly combined metallurgy and hardsurfacing techniques.

"For example, a selector valve part (see Fig. 1) was subject to wear all over. The customer tried unsuccessfully to use machined and cast expensive-metal parts. Our solution: Build up cobalt-base alloy on a carbon steel base, cut away the carbon steel, and machine the part from the cobalt alloy.

"Then there's the Kingsbury shoe pump part (Fig. 2). It was of Type 347 stainless steel but had to be protected against galling. We deposited a ⅛-inch layer of cobalt-base alloy, machined it, and lapped it smooth at 450 F. Result: Part will last years instead of months.

"Another interesting OEM job was a Monel-base needle valve (Fig. 3). First we built up the top of the part with cobalt-base alloy. Then we machined the deposit into the needle.

"Sometimes, even the strongest and most sophisticated metal needs hardsurfacing to protect a pressure point. The pressure on a Monel vent valve we surfaced (Fig. 4) was tremendous. An overlay of cobalt-base alloy in the seat area will protect it for a long time to come."

**AUTOMOTIVE VALVES** are another application of OEM hardsurfacing. Seats and valve-ends are built up with a cobalt alloy that resists heat and impact. After welding, valves are finished to size.

*more OEM case histories follow*

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Dipper teeth dig in and stay sharp when hardfaced and repaired with Amsco's newest electrodes. Both the Nicro Mang* and X-53—the "Pair for Wear"—will handle up to 90% of your hardfacing jobs where high impact and abrasion resistance are needed.

Nicro Mang replaces stainless steel and lets you weld manganese as easily as mild steel. It is a 14% manganese electrode with a deposit hardness of 175 BHN that work hardens to 500 BHN.

Its companion, the X-53, for all general hardfacing jobs, is as easy to run as Nicro Mang. It has a high deposit rate with no spatter and excellent bead characteristics.

Try this famous "Pair for Wear" on your dipper teeth. Leading welding distributors stock them in 50 lb. manual packages or 50 lb. semi-automatic coils. Or, write for your free sample kit containing both these hardfacing rods.

* TRADEMARK REGISTERED

661

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**For More Information Circle No. 10 on Reader Service Card.**

## OEM HARDSURFACING

*continued from page 53*

### SCREW FLIGHTS SURFACED AUTOMATICALLY

DERBY, CONNECTICUT: Farrel-Birmingham Company once hardsurfaced plastic extrusion screws by hand. Now they do it by machine in almost half the time and with 15 percent less alloy. They use Haynes Stellite, (a cobalt-base alloy) and inert-arc welding machine, and a lathe.

One screw they make is of SAE

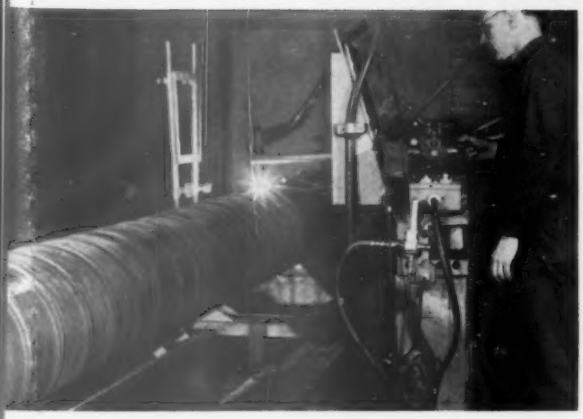
### BORING HEADS LAST THREE TIMES AS LONG

LONG ISLAND CITY: Boring, Inc. is expert in going under things to make way for utility cable and piping. They bore beneath structures, highways, railroads, waterways—often through rock, cement, practically anything, with portable equipment. The company once bought carbide-tipped drill heads to do this work, but they decided to make their own because of the cost of the quickly-worn tools. The tipped heads were spent, as a rule, when they had chewed through 30 feet of rock.

The heads Boring makes gives them over three times the rock penetration the old ones did. They cost a lot less; and downtime and inventory costs are sharply reduced.

To make heads, Boring's welding operator builds up extra-heavy pipe couplings with Eutectic Welding Alloys Corporation's Dril-Tec 88. This composite rod of sized tungsten carbide particles cast in a low-melting matrix alloy deposits a structure with constantly exposed cutting edges. The operator uses a gas torch.

Circle No. 63 on Reader Service Card.



1040 steel, 24-feet-long, 12 inches wide, and has 21-2¼-inch flights. It takes about 150 pounds of alloy to hardsurface the flights, and a 15-inch band on the end of the screw.

Machinists rough mill the screw, leaving flights slightly wider than necessary. Then, without preheating, (it saves time and avoids distortion) the welding operator fills a ¾-inch-wide recess in the flight. This takes two passes. Later, a machinist mills and grinds the deposit accurately to a 63 RMS finish, 3/32 inch thick.

The cobalt-base alloy makes the screws last through its resistance to wear and corrosion. Its soundness is important too. Reason: different colored plastics are processed in the same extruder. A hole could pick up enough dye to ruin the next batch.

*more OEM case histories follow*

STULZ PIERCING ELECTRODES

WELDING ELECTRODES

*The Finest Available!*

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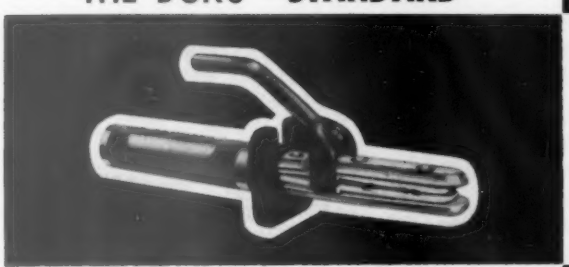

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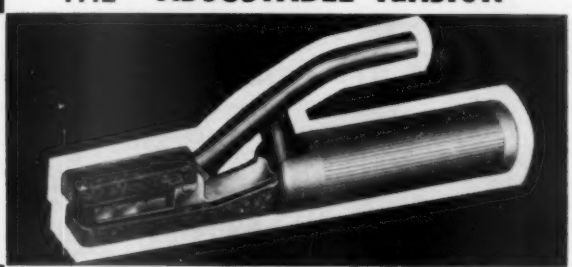

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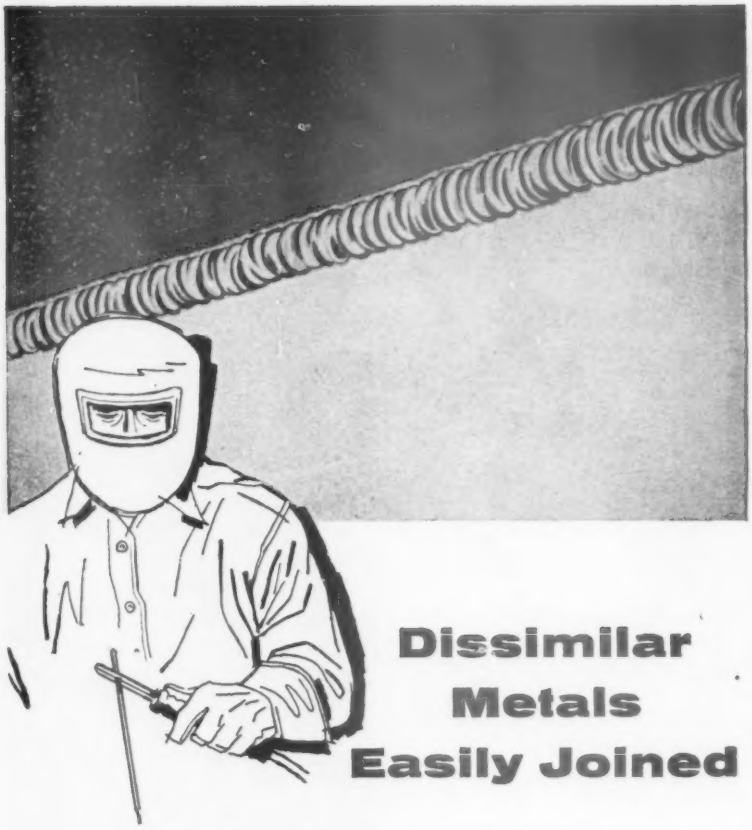

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## OEM HARDSURFACING

*continued from page 55*

### SPRAYED OVERLAY PROTECTS PUMPS

LOS ANGELES: Byron Jackson Company protects Type 410 stainless steel chemical pump sleeves from abrasion and corrosion by hard-surfacing key surfaces. The company puts Wall Colmonoy Corporation's No. 6 powdered-metal alloy (nickel, chrome, boron) on the sleeves. They use a flame spraying gun. (Photos on opposite page.)

A common mistake in selecting hardsurfacing alloy materials for chemical equipment is to choose one that resists corrosion but to forget that it may also have to resist abrasion or galling from metal-to-metal wear. The alloy Jackson uses resists wear as well as corrosion.

Jackson grit blasts sleeves for a good mechanical bond between the base metal and the alloy. Then they mount the sleeve in a turning fixture. The spray gun traverses back and forth and builds up a 0.060-inch overlay.

Next, the deposit is fused to the base metal with an oxyacetylene flame. After controlled cooling (necessary with 410) they grind the sleeve O.D. Final alloy thickness is 0.045 inch.

### FEWER STOPS FOR SHIPYARD CHIPPERS WITH HARDENING COMPOUND

BROOKLYN: Tough armor plate used to dull chipping tools fast at the Brooklyn Navy Yards. And each time a tool quit cutting the chipper had to get another; this took a lot of production time away from the job. Also, it kept the blacksmith humping to keep up with the chipper's demands for reworked tools.

Now, the shipyard hardsurfaces chisel tips with Krembs & Company's Fluxine 101 and they last several times longer than they used to. The compound diffuses hardening and toughening elements into tools. A worker heats the tool to 1,400 F, dips it into the compound, quenches it in water, and sharpens it.

Other shipyards working with armor plate have been quick to follow Brooklyn's way of prolonging tool life.

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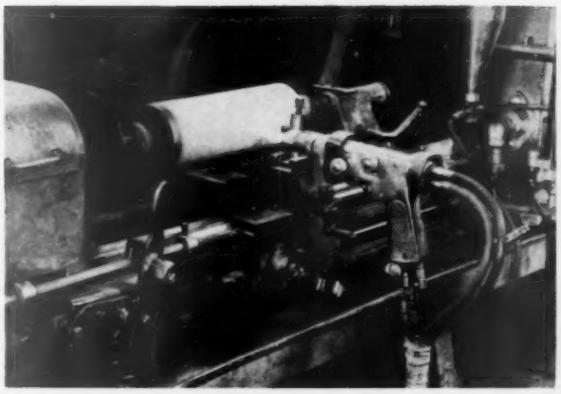
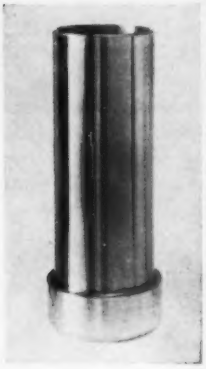


**SPRAY:** Pump sleeve gets 0.060-inch overlay of nickel-chrome-boron powder with traversing spray gun.



**FUSE:** Operator fuses sprayed coating with an oxyacetylene torch. Ground sleeve (extreme right) has 0.045-inch alloy coating which will resist corrosion and abrasion.

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SPOTLIGHT ON FABRICATING

# Template solves tricky drilling job

EDDYSTONE, PA.: What's the best way to drill hundreds of sets of large diameter close-tolerance holes in massive spherical weldments? That was the problem facing Baldwin-Lima-Hamilton's Industrial Equipment Division. They were making four 22-ton assemblies that house a submarine's electronic equipment.

Each assembly consists of a sphere-within-a-sphere: An 11-foot-diameter inner ball of armor plate, capped at either end by truncated support cones and girdled by a network of ribs, around which an outer, incomplete ball of 14-foot-diameter is built. A third cone perpendicular to the axis of the support cones, extends outward from the waist of the spheres.

The third cone connects with sub's inner hull, providing access to electronic equipment inside the inner sphere.

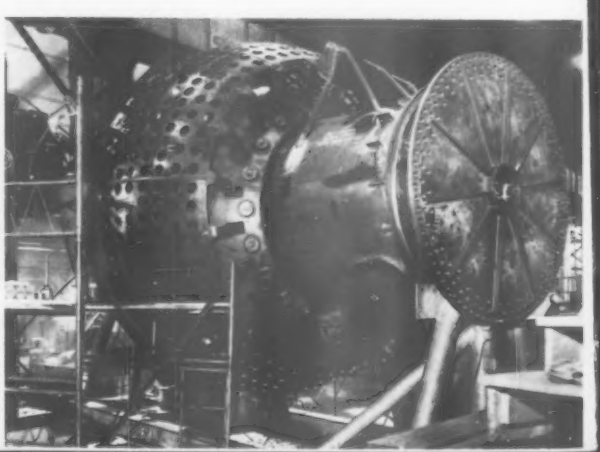
Overall height is 22 feet from tip to tip of the support cones.

Each sphere also is a functional part. Because of this, each set of holes (a set is an outer-sphere hole of one diameter and an inner-sphere hole of another) had to be spaced precisely according to coordinates on a latitude/longitude chart. Each outer-sphere hole (5⅛-inch diameter) became the center for four ¼-inch bolt holes spaced 5.375-inches apart, plus or minus .005-inch.

Enough metal had to be left between the larger holes and ¼-inch holes to assure adequate ligament strength. Holes had to be drilled without cutting into welds, without damaging any support ribs, and without cutting into 400 small spuds on the inside of the inner sphere.

Angle of entry was important. Each set of holes had to be drilled on a centerline which, if projected along the drill's axis, would intersect the inner sphere's geometrical center. Maximum angular tolerance is 3 minutes off true centerline, measured

**RADIOGRAPHIC** inspection checks inner sphere's welds. Sphere was made by multi-pass arc welding 12-foot orange-peel die-formed sections of one-inch HY80 armor plate. Sections were press-formed, heat treated for temper and restruck to size. They were assembled and tack welded around a steel frame to form two hemispheres. After welding, frames were removed and hemispheres joined. Then support cones, the entry cone, and the rib structure around which outer, incomplete sphere will be built were added (right). Spacing between inner and outer spheres had to be held to 18-inches, plus or minus 1/32-inch, to get proper concentricity.



**DRILLING SET-UP:** Sphere assembly is mounted on a cradle, which in turn is mounted on a turntable that has vernier adjustment for positioning work laterally under the drill head. Horizontal boring machine is at left. Template which positions assembly vertically is in foreground, mounted on the end of the support cone. Pin at bottom of template locks assembly in place for drilling.

at surface of the inner sphere.

B-L-H rotated the workpiece instead of the tooling. They used standard, horizontal boring mills, avoiding the cost and delay of special, elaborate movable tooling.

They turned vertical-mounting assembly on its side and fitted it with shaft ends which extended from the cones. Using these as trunnions, B-L-H suspended the entire assembly, now horizontal, on a cradle and mounted the cradle on a standard indexing table. This table's vernier adjustment permitted positioning the sphere surface precisely under stationary drill heads in the lateral plane.

A chain drive, which coupled the trunnion to a drive motor mounted on the cradle, rotated the assembly in a vertical plane past drill heads.

These two positioning arrangements permitted full movement of the sphere assembly surfaces on both vertical and horizontal axes, without shifting of the geometric center of the inner sphere. This would have thrown the fixed drilling heads out of axial alignment with the center.

The vertical adjustment was more difficult. A fresh positioning adjustment had to be made for each hole drilled. Each adjustment had to be held within .002-inch tolerances.

B-L-H devised an ingenious, circular steel template (96-inch-diameter). The charted coordinates of the latitude-longitude chart were projected onto the steel plate. Holes corresponding to these coordinates were drilled in three concentric rings toward the outer edge of the template. The finished plate was mounted on the support cone of the assembly, on the end opposite the trunnion drive.

To position vertically, the operator had only to rotate the assembly on its axle until the desired template hole lined up with a master hole. Then he put a pin into the lined-up holes and drilled.

This guide-template solution made drilling simple and foolproof.

The horizontal boring mills, on each side of the assembly, drilled outer sphere holes first around each ring. A bushing was then fitted on each outer hole and the trepanning tool was moved in through the outer hole, which guided drilling of the inner hole, on the same centerline.

Drilling each sphere assembly took three months, considerably faster than by any other method. • •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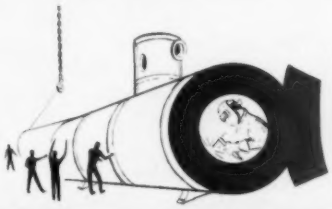

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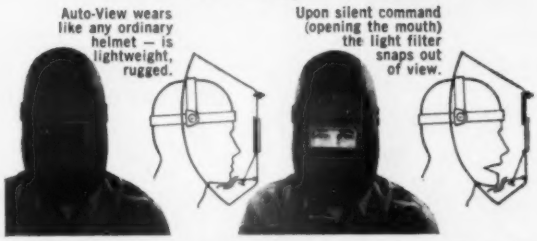
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**The operating principle of Auto-View is simple. To remove the light filter, you open your mouth. Under your chin a comfortable pad actuates a mechanism to remove or replace the filter. For a quick look, just open and close your mouth. For prolonged looking, a HOLD button locks the filter out of the way until you start to weld again.**

**Auto-View is particularly useful in tight places, where it would be difficult to tilt an old-fashioned helmet. In any situation, the Auto-View saves time, makes the welding job easier, and provides greatly increased quality of work. Write for literature.**

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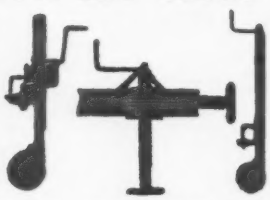

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# New copper-zirconium alloy can improve resistance welding

says **HAROLD KRUITBOSCH**, *chief engineer, Electroloy Company*

IN BRIEF: A new alloy is said to have properties superior to some of the resistance welding alloys now in use.

A NEW ALLOY of oxygen-free, high conductivity copper and zirconium has many advantages when used for resistance welding electrodes. We call the alloy Electroloy Z. We process it from Amzirc, a product of American Metal Climax, Inc., containing a maximum of 0.15 percent zirconium alloyed with 99.9 percent pure copper.

### A WORD OF CAUTION

A comparison of physical characteristics, advantages, and results obtained by using the new alloy follows. It is not intended as a blanket recommendation for complete replacement of other alloys in use today. It is only a guide. You won't get maximum benefits from this new alloy just by replacing the electrode alloys you are now using and going right into production. Remember that machine settings, electrode dressing schedules, and other operating practices must be based on production experience with the new alloy.

### CHARACTERISTICS

Resistance welding alloys in common use today have been classified as Class I and Class II by the Resistance Welding Alloy Association and the Resistance Welder Manufacturers' Association. These represent a series of the best available compromises of the properties for various applications. These are necessary since increased hardness is obtained with a decrease in electrical conductivity, or vice versa. The highest combination of hardness and conductivity obtained with Class I alloys, for example, has the shortest high heat life. We feel that zirconium cop-

### COMPARATIVE PROPERTIES

| | *Class I Alloy* | *Class II Alloy* | *Electroloy Z Alloy* |
|---|---|---|---|
| Electrical Conductivity % I.A.C.S. | 85-90 | 80-85 | 90-95 |
| Hardness Rockwell "B" | 70-78 | 75-82 | 75-82 |
| Annealing Temperature F° | 670° | 960° | 1,000° |
| Ultimate Strength P.S.I. | 65,000 | 75,000 | 70,000 |
| Yield Strength P.S.I. | 55,000 | 70,000 | 60,000 |
| Elongation % in 2" | 15 | 15 | 15 |

### ABOUT PROPERTIES

Copper alloys used for resistance welding electrodes have three important properties:

*Electrical conductivity* indicates the capacity of the material to deliver high amperage current efficiently to the weld area. In inverse ratio, it also affects the contact resistance between the electrode welding face and the pieces to be welded.

*Hardness* is a measure of the electrode material's ability to apply forging pressure to the weld without excessive deformation, cracking, and wear.

*High heat life* is the alloy's capacity to maintain these physical properties during repeated use at elevated temperatures.

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per exhibits properties superior to both these classes.

Our statistics show that Electroloy Z has high electrical conductivity and can transmit the high amperage welding current efficiently. It also has a resultant lower electrode contact resistance. This allows more welding heat to generate at the weld interface where it is needed and reduces surface heating between the work piece and electrode face. Less heat between the work piece and electrode reduces surface annealing of the electrode face, resulting in longer wear and a measurable reduction in pickup from materials such as aluminum, magnesium, and coated steels.

Our new alloy has excellent hardness, ultimate strength, and yield strength. These combine to provide a material that can apply necessary forging pressure without excessive deformation and wear.

It also has a favorable annealing temperature which is one indication of high heat life. Our tests results show that zirconium copper has a lower percentage loss of ultimate strength over a period of time at elevated temperatures—thus, a superior heat life.

Ductility of electrode alloys at elevated temperatures is also an important factor in high heat life. Cracks on spot welding electrode faces or peripheral cracking on welding wheels, caused by heavy duty welding with Class II alloy on coated or plain steels, create defective welds almost immediately. This is caused largely by reduction in ductility at elevated temperatures. We find zirconium copper has a very small loss of ductility at elevated temperatures.

Currently recommended practices call for using Class I alloy on aluminum, magnesium, scaly steel and coated steels, and aluminized and galvanized steels to reduce electrode pick-up. Class II alloys are recommended on hot rolled, pickled and cold rolled steels because of negligible pick-up problems and longer electrode life.

The lower annealing temperature of Class I electrodes has made it necessary to substitute Class II electrodes when welding the materials listed above for Class I. This has been particularly necessary on heavy duty, high speed production welding lines as in the automotive industry which is using an increasing amount of galvanized steel. Electrode pick-up of zinc and cracking of the electrode welding face, however, has created weld quality problems.

The new zirconium copper alloy has been used now for two years on such production lines. We understand it has shown considerably less pick-up, increased electrode life, and consistently higher quality welds. The electrodes also give excellent results when used on uncoated steels.

The new alloy has been tested in the laboratory and has met military standards in production of magnesium, aluminum, stainless, nickel, Inconel, and molybdenum.

Results of our tests show a breakdown of tip diameters and radii after a maximum of 450 welds by Class I and Class II alloys when used on the metals for which they are classified. The zirconium copper alloy maintained tip diameter and radii after 800 spot welds on all of the metals welded. Welds were of consistent high quality. Frequency of dressing on aluminum and magnesium was reduced. • •


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Photo Courtesy The Lincoln Electric Co.

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# Magnetic particle testing of brazed joints in nonmagnetic stainless

by **MAXWELL PEVAR**, *engineering supervisor, Instruments Division, The Budd Company*

**IN BRIEF: New spray-on inspection system depends on brazing alloys changing their magnetic properties after brazing. The system also provides a permanent record on plastic film.**

SOME NONMAGNETIC brazing alloys become magnetic when alloyed to nonmagnetic stainless steels.

This property makes our new magnetic particle inspection system ideal for the nondestructive testing of brazed joints (including those in honeycomb panels) in stainless steels normally considered nonmagnetic.

Our Recordaflux system can be used to determine whether the brazing alloy has alloyed with the base metal. It shows wetting (presence of braze metal) at the joint. Both of these conditions indicate a satisfactory braze. This means the system can be used to detect the following: lack of braze metal at the joint, incomplete melting of the alloy, excessive brazed fillet, puddling of brazed metal, alloying of brazed metal with base metal, deformed core (in sandwich structures), and excessive pene-

**MAGNETIC PROPERTIES OF BRAZING ALLOYS** (ability to attract particles)

| Brazing Alloy | Base Materials—.010" and .060" Gage | | | | |
|---|---|---|---|---|---|
| | Unfused Powder on A-286 | Fused on Porcelain | Fused on 301 | Fused on A-286 | Fused on Inconel X |
| Nicrobraz 4775 | None | None | Weak | Mod. Strong | None* |
| Nicrobraz 50 | None | None | —** | Mod. Strong | —** |
| Nicrobraz 40 | None | None | Strong | Strong | None |
| CM 53 | None | None | Strong | Strong | None* |
| Nicrobraz 4777 | None | None | Mod. Strong | Strong | None |
| Nicrobraz 20 | None | None | Mod. Strong | Strong | None |
| Nicrobraz 10 | .010"-Strong .060"-Mod. Str. | Strong | Strong | Strong | Strong |
| CM 52 | None | None | Strong | Strong | None* |
| CM 50 | .010"-Strong .060"-Mod. Str. | Strong | Strong | Strong | Strong |

* Slight at 2100 F; non-magnetic when brazed at 1925 F. ** Not tested.

**COMPOSITION OF BRAZING ALLOYS AND BASE METALS**

| Brazing Alloy | Analysis | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ni | Cr | B | Si | Fe | C | P | Mn | Mo | Ti | Al | V | Cb |
| Nicrobraz 4775 | 73.2 | 13.5 | 3.5 | 4.5 | 4.5 | 0.8 | | | | | | | |
| Nicrobraz 50 | 76.85 | 13.0 | | | | 0.15 | 10 | | | | | | |
| Nicrobraz 40 | 81.85 | | | 10 | | 0.15 | 9 | | | | | | |
| CM 53 | 82.6 | 7.0 | 2.9 | 4.5 | 3.0 | | | | | | | | |
| Nicrobraz 4777 | 83.55 | 6.0 | 3.0 | 5.0 | 2.5 | 0.15 | | | | | | | |
| Nicrobraz 20 | 87.85 | | | 12 | | 0.15 | | | | | | | |
| Nicrobraz 10 | 88.85 | | | | | 0.15 | 11 | | | | | | |
| CM 52 | 92.2 | | 3.3 | 4.5 | | | | | | | | | |
| CM 50 | 94.2 | | 2.3 | 3.5 | | | | | | | | | |
| Structural Alloy | | | | | | | | | | | | | |
| 301 SS | 6-8 | 16-18 | | 1.0 max | 72.85 | 0.15 max | | 2.0 max | | | | | |
| A-286 | 25 | 14.75 | | | 56.42 | 0.08 | | | 1.25 | 1.90 | 0.35 | 0.25 | |
| Inconel X | 73 | 15.0 | | | 7.00 | 0.04 | | | | 2.40 | 0.60 | | 1.0 |

tration of braze metal into base metal.

The system may be refined to detect the difference between intergranular diffusion of braze metal and solid state fusion with the base metal.

A solution consisting of magnetic particles suspended in plastic is applied as an aerosol spray. We then apply a portable magnetizer to get a magnetic field. The particles migrate to transition regions between areas of different magnetic permeabilities. The solution dries as a film in 25 minutes—faster if heated. You can then strip it off to get a permanent record for filing, project it as a lantern slide, or reproduce it.

The plastic film can be washed off with water if no record is needed.

We have had success to date in tests with a number of stainless steels (A-286, AM-355, Type 301) and brazing alloys. Further tests will be made on the magnetic behavior of various other base metal-brazing alloy combinations.

One important finding is that normally nonmagnetic brazing alloys (Nicrobraz 20, 40, 4775, 4777 and Coast Metals 52 and 53) become strongly magnetic when alloyed to normally nonmagnetic stainless steels (A-286, AM-355 and Type 301) at brazing temperatures of 2000° F. This effect is easily observed on metals up to 0.060-inch thick.

No magnetic change occurred in these alloys when they were melted in separate porcelain crucibles at 2000° F. This confirmed our belief that the magnetic change results from the alloying with the base metal.

Little change was noted when the base metal was Inconel X. When brazing was done at 2100° F, previously nonmagnetic Nicrobraz 4775 and Coast Metals 52 and 53, showed a slight attraction for the magnetic particles.

We also investigated the magnetic properties of a number of brazing alloys used on 0.010- and 0.060-inch A-286 stainless.

We positioned the alloys in powder form in strips along one surface of the A-286 sheet with a plastic binder, after two horizontal strips had been painted with a mask-off solution. We then brazed the sheets at 2000° F in an argon atmosphere and photographed the brazed surface. Then we Recordafluxed the sheets from the opposite side.

The photographs showed clearly the indifference of the Recordaflux system to the nonmagnetic alloys before brazing—only the magnetic Nicrobraz 10 and Coast Metals 50 show up. The photographs also show the close correspondence of the Recordaflux record after brazing with the actual appearance of the sheet after brazing.

The lack of wetting in the horizontal areas that had been painted with mask-off showed clearly, particularly on the 0.010-inch samples.

We made a further investigation of the sensitivity of the magnetic particles to poor wetting quality at the node-to-skin joints of lightweight corrugated core-to-skin sandwich structures.

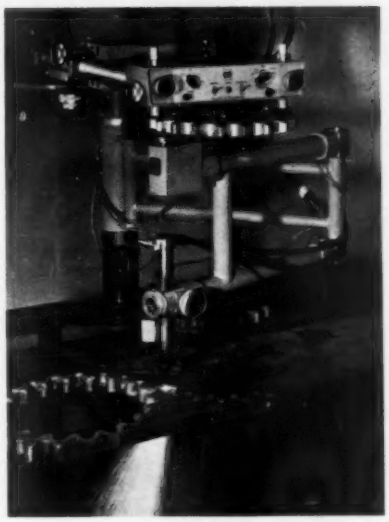
We placed Nicrobraz 10 powder along the nodes of type A-286, 17-7 PH, and AM-355 stainless steels, and L-605 cobalt-base and Inconel nickel-base alloys after we had painted mask-off at several locations along the corrugations.

After brazing, unwetted areas were detected with magnetic particles.

**SPOT WELDS** in magnetic metals can be inspected the same way as brazed joints in nonmagnetic stainless. Operator sprays on magnetic particles suspended in plastic, strips off film after it has dried, and inspects questionable weld areas.


*with a Heath Ultra-Graph*

**Make a new set of teeth in minutes**



It takes six minutes to flame cut a sprocket. In that six minutes nineteen teeth with smooth finishes are formed—and for very little.

The cost of each sprocket is low because operating costs are low. With automatic torch lighter and valve manifold the Ultra-Graph lets the operator shut off the torch after each cut to save gas. A press of a button relights the torch without readjustment. Once cutting begins the operator is free to clean and prepare for the next cut. It's simple and easy. Send now for more information.

**HEATH ENGINEERING COMPANY**

P. O. BOX 821
FORT COLLINS, COLORADO

Circle No. 35 on Reader Service Card.

# flaw hunter

with this in hand

**you find cracks and hidden surface flaws**

*in* ✓ **metals**
*in* ✓ **plastics**
*in* ✓ **ceramics**
*in* ✓ **glass**
*in* ✓ ***minutes***

use **PIXchek** penetrant dye system for inspection after any metal-working process—casting, forging, welding, grinding, extruding, drawing, shearing—the gamut of operations. PIXchek is equally adaptable to single part or quantity-run inspection.

**Everything you need is in this handy flaw-hunting kit**

Sturdy steel hinged case with aerosol spray cans of PIXchek Dye, Cleaner, and Developer, plus extra cans of Dye and Cleaner for brush and wipe-on applications. The coupon below can start you flaw hunting right away.

only **$35**

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**Circle No. 53 on Reader Service Card.**


# REFERENCE DATA *catalogs, handbooks, manuals*

**THE WEAR PROTECTION** provided on industrial and construction equipment by Air Reduction Sales Company's hardfacing alloys is discussed in detail in a 44-page brochure. Form ADC 955 presents over 100 specific equipment parts that benefit from hardsurfacing with the type of wear to which each is subject and the alloy needed to protect. Alloys are cross-referenced and classified according to use.

**Circle No. 300 on Reader Service Card.**

**WELDING AUTOMATION** is a 16-page catalog that illustrates and describes 68 special welding units available from Acro Welder Manufacturing Co. Bulletin 261 groups models under these classifications: Acromatic special resistance welders; Acro-Arc special arc welders; Acro standard resistance press welders; Acro-Magnetic magnetic force welders; and Acro standard resistance welders.

**Circle No. 301 on Reader Service Card.**

**TWO NEW PRODUCTS** for hard surfacing are described in brochure published by CleMet Products of Cleco Air Tools, a division of Reed Roller Bit Co. Bulletin CMP-1060 covers Clec-Ite, a granular tungsten carbide. The other features Clecoloy, a new tubular tungsten carbide available in rods for oxyacetylene or atomic hydrogen.

**Circle No. 302 on Reader Service Card.**

**AN AUTOMATIC REBUILDER** for use on rollers, idlers, and wheels up to 40-inches in diameter is featured in Bulletin MI-402 from the Automatic Welding Company. The Dual Head Micro-Matic is described and illustrated. Construction features and operating instructions are given.

**Circle No. 303 on Reader Service Card.**

**"WELDING PRESSURE PIPE** Lines and Piping Systems" contains practical information on welding techniques and costs related to cross country transmission and pressure piping systems. The bulletin reviews API pipe specifications, analysis, and physical properties and contains charts on pounds of electrode consumed per joint for various diameter pipe using either manual or full automatic submerged arc welding. Bulletin is offered by Lincoln Electric Co.

**Circle No. 304 on Reader Service Card.**

**MAGNETIC CRACK DETECTOR** called Seal-Lock Model S-20, is described and illustrated in a brochure available from United States Casting Repair Corp. Brochure lists the versatility of the S-20 for finding cracks, flaws and defects. Specifications and operating instructions are included for unit which produces a powerful d.c. magnetic field.

**Circle No. 305 on Reader Service Card.**

**GRINDING BULLETIN** from the Delta Power Tool Division, Rockwell Mfg. Co., describes a new 7-inch model with headlights. The bulletin features Twin Lite, the double strength, shatter-proof glass safety shields with built-in lights. It also lists specifications for the grinder and for electrical characteristics of available motors.

**Circle No. 306 on Reader Service Card.**

**FACTS AT YOUR FINGERTIPS:** *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

**TUNGSTEN CARBIDE** hard metal for industry is described in a brochure available from A & B Metal Mfg. Co., Inc. This hard surfacing metal is available as tube metal, composite rods, bulk metal, and inserts.

**Circle No. 1 on Reader Service Card.**

**ABRASION, IMPACT,** heat, and corrosion resistant alloys in all forms are described in data from Coast Metals, Inc. The loose leaf binder contains the latest information and technical data on the Coast Metal line.

**Circle No. 315 on Reader Service Card.**

**SURFACE HARDENING** and heat treating compounds are described in a folder from Kasenit Co. Included are the different compounds available plus a brief description on the application of each.

**Circle No. 42 on Reader Service Card.**

**NEW COLUMN-CONNECTING** clip and wedge is shown in a data sheet available from Saxe Welded Connections. Mechanical drawings show the clip and wedge in erection connections of steel columns and piles.

**Circle No. 307 on Reader Service Card.**

**A HARD SURFACING** electrode for overlays subject to metal-to-metal wear or severe earth-scouring is featured in a data sheet from McKay Company. Operating characteristics, mechanical properties, and typical composition are given for Hardalloy 48, an iron powder, low hydrogen surfacing electrode.

**Circle No. 308 on Reader Service Card.**

**TOOLS OF ALL TYPES** are featured in Catalog. No. 700 from Armstrong Bros. Tool Co. Thousands of tool holders, set-up-and-hold-down tools, tool bits, wrenches and sockets, and hand and pipe tools are described and illustrated. Included are 330 new tools.

**Circle No. 309 on Reader Service Card.**

**EQUIPMENT FOR REBUILDING** track-type track assemblies is described and illustrated in a 16-page catalog from Victor Equipment Co. Included are specifications and operating instructions for a variety of machines including automatic roller and idler rebuilders, automatic grouser show and sprocket reconditioners, automatic track link welders, and grouser bar welders.

**Circle No. 310 on Reader Service Card.**

**PRESSURE BLASTING** with manufactured abrasives is discussed in a report from Norton Company. This report explains the proper selection and use of aluminum oxide and silicon carbide abrasives. Charts and drawings give useful operating information on popular types of media and equipment.

**Circle No. 311 on Reader Service Card.**

**BUILD-UP** and hardfacing catalog carries product features, ordering information and prices on a complete line of hardfacing and manganese steel build-up material. The well-illustrated, 16-page catalog is issued by American Manganese Steel Division of American Brake Shoe Co. Featured are rods, electrodes, tooth repointers, bar, plate, and special shapes. Typical applications are shown.

**Circle No. 316 on Reader Service Card.**

**FRICTION WELDING** is practical. That's what a report from AMF's Central Research Laboratory says. The report answers questions on friction welding, describing and illustrating friction welding a variety of materials.

**Circle No. 312 on Reader Service Card.**

**ABRASIVE WHEELS** for weld grinding and finishing are featured in Bulletin ESA-244 from Simonds Abrasive Co. Described and illustrated are Double XX and Fibrex reinforced, resinoid-bonded abrasive wheels. New "U" grade of hardness for Double XX wheels is explained.

**Circle No. 313 on Reader Service Card.**

**HIGH STRENGTH** aluminum clamps with threadless spindles are described in a catalog from United Clamp Mfg. Co., division of United Screw Machine Products. Catalog gives sizes, prices, shipping information, the range of spindle types and materials, and accessories.

**Circle No. 314 on Reader Service Card.**


**Circle No. 54 on Reader Service Card.**

**product defects**

**getting you down?**

***let us help you...***

- ***find hidden cracks*** with magnetic particle or dye penetrant inspection equipment
- ***find deep-lying defects*** with x-ray or gamma radiography equipment
- ***see "innards" directly*** with bright-image fluoroscopes
- ***work out the method*** at our Industrial Applications Lab

**call any local Picker office**

where a technical expert is always near (see 'phone book) or write

Picker x-ray

25 So. Broadway, White Plains, N.Y.

INSIST ON

**HI-AMP®**

MANUAL ARC WELDING

ELECTRODE HOLDERS

GROUND ATTACHMENTS

Buy from your local

WELDING SUPPLY HOUSE

**LENCO, INC.**

350 W. ADAMS ST., JACKSON, MO.

**Circle No. 43 on Reader Service Card.**

# NEW PRODUCTS

## Coil Welding

Two Cleveland companies, Guild Metal Joining Equipment and Mechanical Equipment Co., have combined efforts to produce a coil steel welding and looping machine smaller, cheaper, and far faster than other units. The unit takes strip up to 3/16 inch thick and 15 inches wide. The strip moves from the uncoiler through a flattener to the welder at 150 feet a minute. The ends are sheared with a 15° angle and TIG welded before all the strip is used from the loop. The loop feeds subsequent operations (like roll forming) while the two ends are being welded.

**Circle No. 201 on Reader Service Card.**

## Cable Connector

A quick-detachable welding cable connector, called Ball-Point, is marketed by Tweco Products, Inc. Tighten the large ball-point screw with a hex wrench and it compacts the bare cable strands, crushing oxide for full current flow. Installation is under 2 minutes on either aluminum or copper cable.

Three Ball-Point sizes fit 4 through 4/0 cable. A quarter turn locks the connector. Cables 1/0 through 4/0 have Neoprene insulation; through 1/0 have fibre insulation.

The Ball-Point is interchangeable with other Tweco quick-detachable connectors.

**Circle No. 202 on Reader Service Card.**

## Inclined Projection Welder

A multi-gun inclined projection welder for joining hinge brackets and leg assemblies to the top rim of card table frames has been developed by the Federal Machine and Welder Co. The inclined frame mounts four of the following at each corner: dual welding guns, transformers, clamps, and locators. The machine adjusts to various table sizes.

**Circle No. 203 on Reader Service Card.**

## Aluminum Bonding

Eco-Bond '61 for bonding aluminum without fluxes has been developed by Paraco Metals, Inc. With this new concept in aluminum fabrication, you merely preheat the aluminum to melting temperature of Eco-Bond '61 (717° F), then rub it on. The parent metal is said to tear or break before the bond gives.

**Circle No. 204 on Reader Service Card.**

## Hard Surfacing Electrode

A new hard surfacing electrode that gives maximum protection against metal-to-metal frictional wear or severe earth scouring under low stress is available from McKay Company. The company's new Hardalloy 48 is an iron powder, low hydrogen electrode which deposits sound, extremely smooth deposits 50 percent faster than conventional coated electrodes. It operates on a.c. or d.c. reverse polarity with a very quiet, stable arc, fast transfer, minimum penetration or base dilution, and good wetting characteristics.

Electrodes are available in ⅛-, 5/32-, and 3/6-inch diameters in 14 inch lengths. One pound of electrode covers 18 to 22 square inches, ⅛ inch thick.

**Circle No. 205 on Reader Service Card.**

## Twin-Tip Holder

Harris Calorific Co., has introduced a new adjustable twin-tip holder that makes possible two simultaneous cuts within a spread of 1½- to 12-inches from one machine cutting torch. Harris describes the TH-98 as being particularly applicable to sheet and plate strip cutting. It will operate on any gas, on all Model 98-2 Harris machine cutting torches, using Series 6290 cutting tips. O-ring seals at the pivot point provide complete safety to the 360° circumference of the tips.

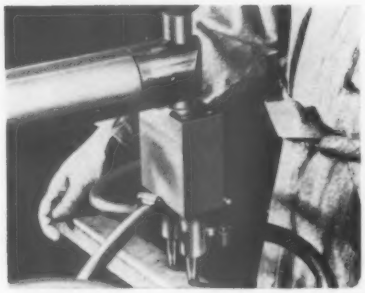
**Circle No. 206 on Reader Service Card.**

## Bevel-Mitre Saw

Promacut Uni-12A is a bevel-mitre cut-off saw made by Production Machinery, Inc. It will rip through 35# ship channel without coolant, or through lightweight profiles without misshaping or burring. The saw has an alloy steel circular saw blade whose teeth produce a semi-milling

action rather than biting or chipping. The 12hp motor moves the blade through stock so fast that heat is not absorbed. A burn-free cut results. The blade is easily tilted for angles up to 45°.

**Circle No. 207 on Reader Service Card.**



### Dual Tip Holder

A new spot welding electrode holder has been announced by Air Reduction Sales Co. Called Equa-Press Dual Holder, it exerts equal forging pressure through its two tip-holding barrels regardless of minor variations in work thickness or electrode wear. Weld spacing can be 4 inches with offset tips. Models are available for arm mounting (pictured) or for bolting to a platen.

**Circle No. 208 on Reader Service Card.**

### Portable Power Hacksaw

A portable Jefferson 601 power hacksaw has been added to the Keller line made by Sales Service Mfg. Co. The saw will cut stock up to 5-inches-wide by 4-inches-deep. It will saw at angles up to 45°. Stroke is 3¾ inches.

The saw features Oilite bearings throughout, a ¾ hp-1725 rpm motor, and an automatic shut-off switch. Saw frame is equipped with adjustable replaceable bronze wear strips.

The rear pair of rugged cast legs is equipped with 7-inch rubber-tired ball-bearing wheels.

**Circle No. 209 on Reader Service Card.**

### Nuclear Gages

A new line of nuclear gages has been announced by Radionics Incorporated. The basic gaging unit, Micro-Meter, uses scintillation which provides a current pulse for each radiation particle interacting with the detector. The gage can use almost any radiation source, depending on material to be gaged, its thickness, and the sensitivity required. Applications will include: thickness, density, level measurement and control, flaw detection, and dimension gaging.

**Circle No. 210 on Reader Service Card.**

### Safety Cap/Goggles Connection

Telescopic aluminum side arms that combine safety cap and goggles, are in production at Fibre-Metal Products Company. Illustrated are Super-Glas Safety Cap and Golo goggles connected by the adjustable, quick connect-disconnect, Quick-Lok side arm attachment.

**Circle No. 211 on Reader Service Card.**

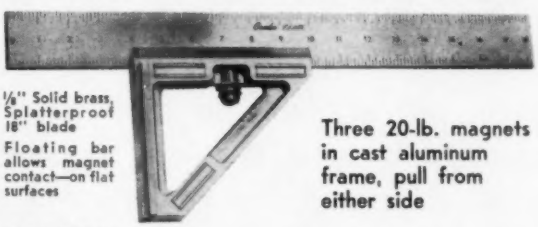

**SAW HOLES**
***Through Sheet or Plate!***

With a MARVEL No. 1 Hole Saw Kit, you can save time and labor by sawing holes from ¾" to 2½" diameter in sheet or plate, using an ordinary portable electric drill or a drill press. Saws to cut holes from 9/16" up to 6" dia. are available. MARVEL High-Speed-Edge Hole Saws are heavy duty tools, having a cutting edge of high speed steel welded to a tough alloy steel body to insure fast cutting and long service life. Arbors are heat treated, rugged, and practically indestructible. No. 1 Kit is complete with ¾", ⅞", 1⅛", 1⅜", 1½", 1¾", 2", 2¼", 2½" Saws with necessary Arbors. See your MARVEL Distributor, or write for Hole Saw Bulletin HS-475.

**ARMSTRONG BLUM MFG. CO.**
5700 W. Bloomingdale Avenue • Chicago 39, Illinois

**For More Information Circle No. 15 on Reader Service Card.**

**FESCO COMBO MAGNETIC WELDORS LAYOUT & CUTTING SQUARE**



⅛" Solid brass, Splatterproof 18" blade

Floating bar allows magnet contact—on flat surfaces

Three 20-lb. magnets in cast aluminum frame, pull from either side

**NEW!** Eliminate C-clamps and cutting guides. Save time and money with COMBO cutting and layout square.

**NEW! WELDING HOSE REPAIR TOOL**

No hammer, vise or other tools needed.

The fastest welding hose tool on the market. Does a machine-like job. Repairs 3/16" and 1/4" single and twin hose.

FESCO #30 Hose Repair Tool

Available from your local welding or industrial supply dealer

**R. C. FESSLER & CO.** 1634 Colorado Blvd. Los Angeles 41, Cal.

**For More Information Circle No. 70 on Reader Service Card.**

## ARCOS STAINLESS OVERLAY CUTS COST

Job Report Courtesy of Pottstown Metal Products Works
Cochrane Div. of Crane Co., Pottstown, Pa.

**Arcos stainless overlay cuts overall cost of chemical reactor 10%.** The application of a stainless overlay to the face of a carbon steel flange, not available in clad material and too expensive in solid stainless, resulted in a 10% overall saving in the construction costs of an unusual epoxy resin reactor. The overlay was applied by automatic submerged arc, using Arcos Type 308 bare wire and Arcosite C7 flux. This is another example of the economy and performance you get with Arcos stainless filler metal products.

ARCOS

**Arcos Corporation • 1500 S. 50th St. • Philadelphia 43, Pa.**

For More Information Circle No. 13 on Reader Service Card.

### Wire Feed Unit

Alloy Rods Company announces a wire feed unit for semiautomatic open arc hard surfacing in hard-to-get-at places. The Wear-O-Matic Model C provides 2½ times the wire supply of other coil-type machines, with equal portability and weight. A Weld-Pak is an integral part of the wire feed unit. It provides 125-feet of continuous welding wire. This cuts down on time lost in changeovers by as much as 67 percent and eliminates short coil loss.

**Circle No. 212 on Reader Service Card.**

### Double Exhauster

A dual table-type exhauster that eliminates welding fumes and reduces heating bills is Car-Mon Products, Inc's new Dual Tab-L-Exhauster. A single fan draws off all gases, smoke, heat, and fumes from both receptors. Receptors have magnetic bases that keep them put. Hose is long, flexible, weldproof tubing; motor is induction-type ¾ h.p. (one or three phase) that never needs lubrication.

**Circle No. 213 on Reader Service Card.**

### Magnetic Level

A magnetic level, called Lev-L-All, for flat and curved surfaces leaves both hands free. It has been developed by Alan-Lea International Inventions Corp. One easy-to-read bubble permits accurate 45°, 90°, and horizontal readings. Its Alnico permanent magnets are concealed within its heat, cold, and moisture resistant plastic body. It measures 3⅜ inches-long,

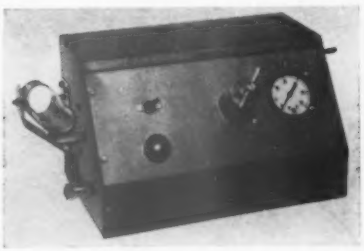
1¼ inches-high, and ⅞ inch-wide and weighs 2½ ounces. Accessories include a belt pouch and an adaptor for non-ferrous surfaces.

**Circle No. 214 on Reader Service Card.**

### Arbor Piercing Units

New piercing units, for use in their Compact Air Press, have been announced by Vogel Tool & Die Corp. The circled area in the photo shows the mounted unit. Vogel's Arc-Fit and V-notcher also fit this press. The piercing units are available for perforating tubing, pipe, moulding, flat stock, angles, and channels. Punch and die assemblies can be furnished for holes of any shape.

**Circle No. 215 on Reader Service Card.**



### Automatic Gas and Power Control

An automatic gas and power control designed to save inert gas when welding plastics has been announced by Laramy Products Company. This unit permits gas flow only when welding. It prevents accidental burn-out of heating elements. The control shuts off when gas pressure falls below a safe level.

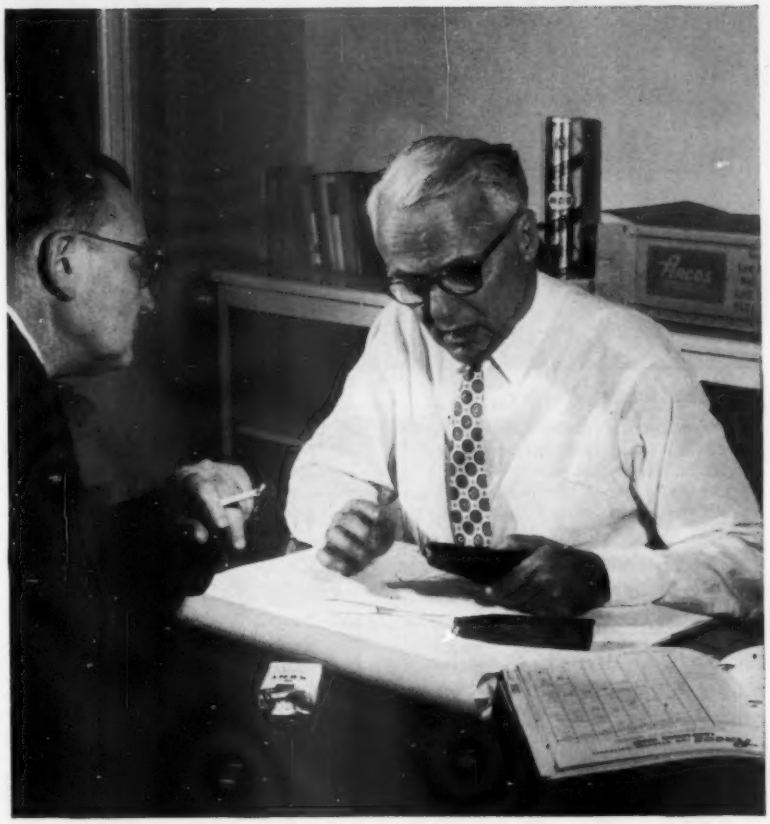
**Circle No. 216 on Reader Service Card.**

### Manipulators

Unique Equipment, Inc. has announced a line of precision, machine tool design manipulators in their UBM series. The new line features concave and convex tracking for longer life, greater accuracy, and trouble free operation.

**Circle No. 217 on Reader Service Card.**


**BETTER WELDING WITH ARCOS SERVICE**



**Know what you're getting—know what you're going to get.** The combination of Arcos quality filler metals and Arcos technical assistance brings you *predictable* welding results you can depend on time after time—job after job. The skills of the Arcos research and service team are available to help solve your problems—to give you top performance on every welding job. You can add quality to your welding and save money by consulting your Arcos representative.

ARCOS

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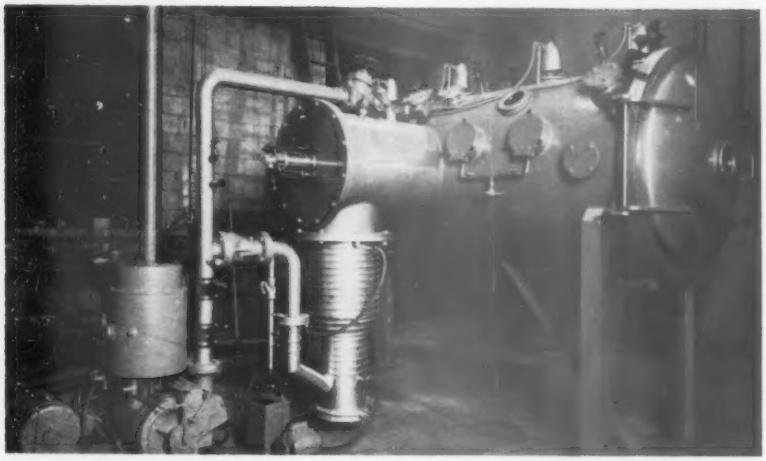
**For More Information Circle No. 14 on Reader Service Card.**



## Electron Beam Welder

The Beamatron welder with a vacuum chamber, has been developed by the High Vacuum Equipment Corp. The vacuum is compatible with the high velocity electron beam and it produces no contamination. Example: nonporous welds in aluminum are common. The unit shown is just one of High Vacuum's line of electron beam welders.

**Circle No. 218 on Reader Service Card.**

## Toggle-Action C-Clamp

A toggle action clamp with a 2,400-psi holding force, has been announced by Fast Grip Mfg. Co. Clamp has a plated spindle with a broad grip. Spindle is adjustable to a full-open 2 inches; nut locks it in place.

**Circle No. 219 on Reader Service Card.**

## Midgit Soldering Iron

An improved midgit soldering iron has been announced by General Electric's Industrial Heating Department. The new iron features a streamlined handle that stays cool, faster tip heating with element closer to the surface, and quick tip changing. The iron comes in ⅛- to ¼-inch tip sizes with six volt, 18- to 35-watt ratings.

**Circle No. 220 on Reader Service Card.**

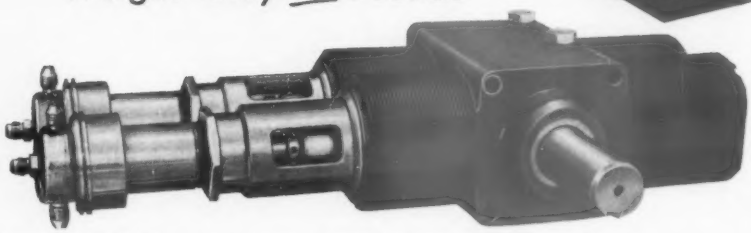
## Cable and Hose Protection

Wear and tear on Mig and Tig welding cables and hoses has been reduced with the designing of a neoprene-coated sleeve by Singer Glove Mfg. Co. Designated C.H.P., sleeve comes in 9, 12½, and 25-foot lengths, and resists all kinds of abuse.

**Circle No. 221 on Reader Service Card.**


NEW HIGH PRESSURE
LIQUID OXYGEN PUMP
*Weighs Only 60 Pounds*

Outperforms Pumps Ten Times Its Weight



**Pressures:** To 15,000 PSI
**Cool-down time:** 5 minutes or less
**Servicing time:** 15 minutes—1 man maintenance
**Insulation:** None required on lines or pump
**Flow Rate:** 2000 scfh to 75,000 scfh of liquid gas to gaseous gas using ambient air or water vaporizers.
**Suction Head Requirement:** Below 20 psig at flows of 30,000 scfh at 3,000 psig discharge pressure.
**Drive:** Electric motor-driven pump close-coupled to motor. No alignment between pump and motor necessary.
- Minimum components.
- All pumps tested with liquefied gas before shipment.

Here's a reliable high-pressure LOX pump weighing only 60 pounds and so compact that it occupies only one-quarter the space of other high-pressure pumps designed for equivalent work loads. A fantastically short cool-down time and ease of servicing make it ideal for use in ground support equipment or wherever it is necessary to handle low boiling point liquefied gases such as oxygen, argon, hydrogen and nitrogen.

No complicated parts . . . no external support equipment such as lubrication pumps, coolers, fans, etc. . . . this pump is so simple it can be disassembled, serviced and reassembled in 15 minutes by non-technical personnel. Building block assemblies of from one to five modular elements fit a wide range of requirements. Units are immediately available.

**Free!**

New 64 page catalog. The largest line of low temperature equipment available. Also valuable cryogenic information.

hofman LABORATORIES, INC.
5 Evans Terminal, Hillside 5, N. J., ELizabeth 4-4016

**For More Information Circle No. 38 on Reader Service Card.**

"No secret—I use only virgin alloys in my spotwelding tips and machine them with the best equipment money can buy."

**Resistance Welding Alloys our only product. An abundant inventory of spotwelding tips and related accessories, as well as the various grades of copper-alloy bar stock, maintained at all times.**

tips—holders—wheels—copper alloy bar stock, forgings and castings

**Catalog Available On Request**

HERCULES WELDING PRODUCTS CO.
11478 Timken Ave., Warren, Michigan
JEfferson 9-2610

**Circle No. 36 on Reader Service Card**

## Half-Ton Truck Hoists

The new Pacific Hoist operates on either 6 or 12 volt current from a truck battery and handles loads up to one-half ton. The hoist features a telescopic boom, adjustable in length and height, with push button remote control. A 360° swing permits back or side loading.

Forty feet of hoisting cable is supplied. Installation is simple and no change in the truck's electrical system is necessary. A minimum of battery current is required. The hoist can be moved from the truck in a shop dolly in a few minutes.

The Model 52P hoist is shown above on a gas truck.

Manufacturer is Hoist Division of Burchaell Heating Company.

**Circle No. 222 on Reader Service Card.**

## Multi-Tip Torch

An adjustable torch with six nozzles has been developed by the Acetylene Supply Co. Torch, looking something like a lobster's claw, is used for sweating pipes and fittings. Called Expano, torch heats from all sides in places in a single tip torch won't reach.

**Circle No. 223 on Reader Service Card.**

## Magnetic Tester

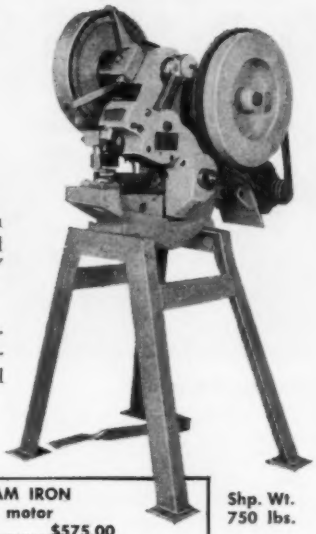
A one-man portable magnetic particle testing unit that produces 1,000 amperes of a.c. or half-wave d.c. to detect surface and sub-surface flaws has been introduced by Picker X-Ray Corp. The new Portable Ferroscope is small enough to fit through openings 18-inches-wide. It can be used with prods or coils. Prods can be used separately or fastened for one-hand use. The unit is fan cooled and offers five-place ampere selection and safety limit switches. Dry-type silicon rectifiers are housed in aluminum for lower weight and temperatures.

**Circle No. 224 on Reader Service Card.**


**For More Information Circle No. 18 on Reader Service Card.**

*Large and Small Fabricators of steel and ornamental iron swear by it ...*

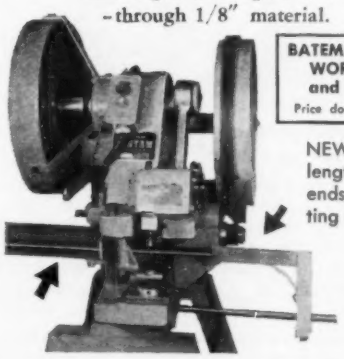
**BATEMAN BANTAM IRON WORKER**



The Bantam cuts and punches fast and clean . . . no grinding necessary. It's versatile, and saves time and labor! Cuts 2" x 2" x 1/4" angle and 1/4" x 4" flats.

Punches 1/2" hole through 1/4" material. Operates by hand or foot, uses 3/4 hp motor (1750) rpm., powered with flywheel and drive gear.

The Coper will cope 1-1/4" -through 1/8" material.



BATEMAN BANTAM IRON WORKER, with motor and stand .....$575.00
Price does not include Blades, Punches or dies.

Shp. Wt. 750 lbs.

NEW ACCESSORIES: Gauge for cutting to length, Guide for Flat Bars for cutting on ends, and Angle Iron Trimming Guide, for cutting at a 45 degree. Write for details.

WRITE TODAY for complete information and name of nearest distributor

**Bateman Foundry & Machine**
MINERAL WELLS, TEXAS

MUD
DOESN'T
They mean National Carbide's calcium carbide—Real potent... it's hot-crushed!
All you want—when you want it. In the RED DRUM. Wire for supplier...
NATIONAL CARBID

Calcium Carbide

National Carbide is a product of:

**AIR REDUCTION CHEMICAL & CARBIDE CO.**

A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED • 150 EAST 42nd STREET, NEW YORK 17, NEW YORK • MURRAY HILL 2-8700

**For More Information Circle No. 3 on Reader Service Card.**

### Cutting Machine

The Wallace Supplies Mfg. Co. has announced a metal cutting machine they call the Cut-Machining unit. The machine will cut an 8 inch I-beam in less than 18 seconds with a machine-like finish. The unit will produce a surface finer than 100 RSM.

**Circle No. 225 on Reader Service Card.**

### Iron-Powder Electrode

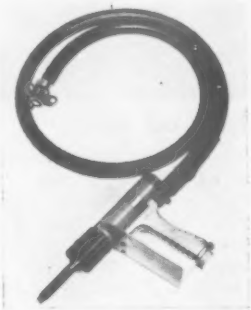
A new E-7018 low-hydrogen, iron-powder, all-position electrode for a.c./d.c. reverse polarity welding has been developed by Metal & Thermit Corp. Designated Speedex HTS, electrode has improved physical and mechanical properties, arc stability and weld contour. Deposits meet MIL Specs E-22200/1 for low-hydrogen iron-powder electrodes. Typical applications: low-alloy high-strength steels, hardenable steels, high-carbon steels, high-sulphur steels and enameling steels. Deposits have excellent impact strength at low temperatures.

**Circle No. 226 on Reader Service Card.**

### Safety Hook

A completely safe hook that can be released while loaded has been added to the line of Merrill Brothers' material handling devices. Called Release-A-Matic, hook allows operator to stand clear while unhooking, eliminating the hazards of live loads. Positive lock prevents opening except when intentionally released by the pull ring. Release-A-Matic hook has been approved by the U. S. Navy.

**Circle No. 227 on Reader Service Card.**



### Heavy Duty Metal Removal

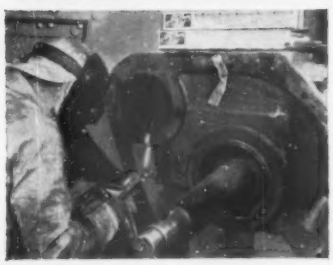
A heavy duty torch designed for heavy metal removal at high amperage has been announced by Arcair Company. The new torch, Model R, was designed primarily for pad washing in foundries. It provides six lines of current contact through its alloy spring-action jaws. The new concentric cable assembly is said to give greater current and air volume capacity, and its high temperature insulators to reduce maintenance and increase torch life.

**Circle No. 228 on Reader Service Card.**


**STEELARC®**

**CUTTING ELECTRODE**

**CHAMFER ROD**



High speed Cutting Electrode slices through cast iron machine housing. This one low-cost electrode cuts any ferrous alloy, lowers inventories.

**the versatile electrodes for field work to JOIN · CUT · SHAPE**

Used extensively in
construction • road building • farming
mining • job shops • maintenance work

STEELARC® is All-State's specially coated electrode for all mild steel work —flat, vertical, overhead positions. Pass on pass without slag removal. AC or DC. One rod inventory.

All-State CUTTING ELECTRODE for fast, economical arc cutting of steel, cast iron, stainless, high chrome armor plate. AC or DC.

All-State CHAMFER ROD for chamfering, gouging, bevelling, routing and channeling without oxygen or air. Made with special compounded flux coating to protect rod and speed work. AC or DC.

**Economical • Practical • Versatile • Distributors everywhere.**

Send for a free copy of our 56-page Manual and Catalog.

All-State

**ALL-STATE WELDING ALLOYS CO., INC.**
White Plains, N.Y. Dial 914 WH 8-4646
QUALITY WITH SERVICE

**For More Information Circle No. 6 on Reader Service Card.**

**QUIK-HEAT®**

**up to 2200° F.**

CLEMENTS

**Cadillac**

MODELS K3 & M2

**BLOWTORCHES**

Here are rugged, high efficiency blowtorches that speed up all types of heat treating and production operations. These two Clements Cadillac Blowtorches provide heat up to 2200°F, in seconds and are fully portable.

With the Clements Cadillac model K3 or M2 you can bring the torch to the work instead of the work to the torch as in fixed installations. Furnished fully equipped with 20 ft. of Underwriters' Laboratories and Canadian Standards Association approved 3-wire cable with plug, 10 ft. of gas hose with fittings ready to attach to your gas line and with sturdy, high stability stand. Easily adjustable for height and direction of torch.

*Operates on natural, manufactured, or LP-gas.*

**CLEMENTS MFG. CO.**
6646 S. Narragansett Ave., Chicago 38, Ill.
*SINCE 1910*
INDUSTRIAL PRODUCTS DIVISION

**Circle No. 21 on Reader Service Card.**

## Berkeley-Davis Purchases Berkeley

DANVILLE, ILL.: Berkeley-Davis, Inc., has purchased the Berkeley Company, also of Danville. The combined operation will be know as Berkeley-Davis, Inc., a wholly owned subsidiary of the McKay Machine Co., Youngstown. The Berkeley-Davis plants have 57,000 square feet of floor space. Current employment is 140.

The merger is part of McKay's expansion program. Berkeley-Davis will continue to build the Berkeley line of standard fusion welders, in addition to its own high production weld mills and special transfer-type welding machines.

## National Tank Completes 10th Year In Business

HAZELWOOD (ST. LOUIS) MO.: The National Tank & Boiler Company has celebrated the completion of 10 years in the fabrication business. The company's new Hazelwood plant comprises 33,000 square feet of manufacturing area and 4,000 square feet of office space.

The company is a wholly owned subsidiary of the St. Louis Steel Castings Co.

## Linde Prepares For Cryogenic Boom

NEW YORK CITY: Plans for a $2.5-million expansion and modernization of manufacturing facilities at Tonawanda, N. Y., have been announced by Linde Company, Division of Union Carbide Corp.

New facilities will be used for constructing on-site oxygen, nitrogen, and hydrogen plants, for making the company's own central producing mass liquid plants, and for fabricating equipment for storing, distributing, and using liquefied gases supplied by a network of central plants.

## Gevaert Changes Atlanta Address

ATLANTA: The Gevaert Company of America, Inc., has moved its Atlanta District Headquarters to 1297 Spring Street, N. W. The telephone number is TR 5-5548.

## Bren/Weld Forms New Sales Organization

BROOKLYN: Bren/Weld Corporation has formed Bren/Weld Sales, Inc., to handle all sales, promotion and advertising of the firm's line of welding equipment. Ingram Carner is president and Nathan N. Zell is sales development consultant.

*more news on page 74*

**ENTERTAINING VISITORS** was the order of the day recently at Hobart Brothers Company, Troy, Ohio. This group includes Hobart distributors from three foreign countries and the publishing director of a welding magazine. From left to right are R. L. Sherwood, Hobart; Willian Harrison, Rockwell, Ltd., England; Tom Dempsey, Welding Design & Fabrication; Harry Lee, Acetogen Welding Supply, Vancouver, B. C., Canada; Mrs. Harry Lee; Senora Pedro Dalma; William B. Howell, Hobart; Senor Pedro Dalma, Electrodos Monterrey, S.A., Mexico City; and William H. Hobart, Jr., Hobart.

Circle No. 20 on Reader Service Card.

**BECKER**

HAS IT...OR CAN MAKE IT—
if it's CARBON or GRAPHITE!

*Graphite Cores and Chills—Graphite Powder and Particles of any mesh... complete Graphite Fabrication Facilities.*

BRUSHES... for all motor and generator applications... carbon, graphite, copper leaf, gauze and metal-graphite.

WELDING ELECTRODES, WELDER BRUSHES... Keen-Cut Electrodes for carbon arc-air jet cutting... Keen-Arc Carbons, cored and heavily copper coated, for twin-arc torches... paste, rods and plates.

EXTRUSIONS, MOLDED SHAPES OR SPECIAL CARBONS designed and produced to your specifications.

COMPLETE BECKER ENGINEERING SERVICE is always available and entails no obligation whatever

*Write for Catalog*

**BECKER BROTHERS CARBON CO.**

3442 South Laramie Avenue • Cicero 50, Illinois
Telephone: BI 2-1260 • Chicago

**HARGRAVE**
*Power Tested*
**WELDERS' CLAMPS**

Spatter Resisting
Solid Alloy Screw
Drilled Frame
For Ground

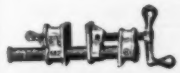
Forged Steel

In 3 Patterns
Regular Duty
Deep Reach
Heavy Duty

A SIZE AND PATTERN FOR EVERY JOB

SPRING | STD. CARRIAGE | FORGED STEEL

HEAVY DUTY | DEEP REACH | QUICK ACTING



CLAMP FIXTURES for ½" and ¾" pipe

BAR CLAMPS Light to Extra Heavy Duty

WRITE FOR FREE CATALOG

**THE CINCINNATI TOOL CO.**
1985 Waverly Ave. • Cincinnati 12, Ohio
THERE IS A DISTRIBUTOR STOCK NEAR YOU

Circle No. 22 on Reader Service Card.

Circle No. 5 on Reader Service Card.

WELD STAINLESS FASTER!

Use **AIRCOMATIC®** Airco's gas shielded metal arc process. Terrific on austenitic plate ⅛" and over. For unbiased advice on any stainless application, call Airco – the only producer of complete equipment for Aircomatic, Heliwelding and stick electrode welding.

AIRCO **AIR REDUCTION SALES COMPANY**

A Division of Air Reduction Company, Incorporated, 150 East 42nd Street, New York 17, N. Y. • On the west coast – Air Reduction Pacific Company • Internationally – Airco Company International • In Canada – Air Reduction Canada Limited • All divisions or subsidiaries of Air Reduction Company, Inc.

**ATTENTION:**
**MANUFACTURERS & DISTRIBUTORS OF ACETYLENE GAS!**

When your truck pulls away from the loading dock your trucking costs per cubic foot of gas depend on how much GAS is in the load — not how many cylinders. If the gas YOU sell is in COYNE CYLINDERS with the higher porosity filler, then you are selling and delivering up to 30% MORE GAS ON EVERY TRUCK, and decreasing trucking cost by 30%.

Get the facts direct from **COYNE cylinder company**

A DIVISION OF AMERICAN CRYOGENICS, INC.

224 RYAN WAY, SOUTH SAN FRANCISCO, CALIFORNIA
155 WEST BODLEY AVENUE, MEMPHIS, TENNESSEE
3800 SPRINGDALE AVENUE, GLENVIEW, ILLINOIS

Circle No. 26 on Reader Service Card.



## Industrial Air Buys Alaskan Firms

PORTLAND, OREGON: Purchase of a group of five Alaskan manufacturing and distributing firms in Anchorage and Fairbanks by Industrial Air Products Co., was announced recently by Gilbert Schnitzer, president. Involved are the facilities of Alaska's only industrial and medical gas manufacturing firm as well as companies distributing welding and cutting equipment.

The purchased companies are Alaska Chemical Corp., Fairbanks; Anchorage Oxygen Co., Anchorage; and Alaska Fire Equipment, Inc., Alaska Welding Supplies, Inc., and Alaska Hospital and Safety Supply. The latter three are all located in both cities.

## Technical Paper Deadline Is July 17

CLEVELAND: Participants in the 1961 $25,000 Award Program sponsored by The James F. Lincoln Arc Welding Foundation, Cleveland, must submit technical papers no later than July 17, according to C. G. Herbruck, Foundation secretary.

This year's program will accept papers in either of two categories. Papers may describe the design of any machine or structure (or components thereof) in which welding is of major importance.

Complete rules brochures are available from the Foundation at Cleveland 17, Ohio.

### COMING EVENTS

**July 18-20:** Western Plant Maintenance and Engineering Show & Conference, Pan Pacific Auditorium, Los Angeles.
**September 14-15:** N.W.S.A. Central Zone Meeting, Palmer House, Chicago.
**September 18-19:** N.W.S.A. Eastern Zone Meeting, Hotel Roosevelt, New York City.
**September 20-22:** AEC Welding Forum, Southwest Research Institute, Granada Hotel, San Antonio.
**September 27-30:** Third Biennial Industrial Exposition, Roanoke, Virginia.
**October 9-10:** N.W.S.A. West Central Zone Meeting, Pick-Niccollet, Minneapolis.
**October 12-13:** N.W.S.A. Western Zone Meeting, Riviera Hotel, Las Vegas.
**October 23-25:** Fall Meeting of Abrasive Grain Association, Waldorf-Astoria Hotel, New York City
**November 27-28:** N.W.S.A. Southeastern Zone Meeting, Atlanta Biltmore, Atlanta.
**November 30-December 1:** N.W.S.A. Southwestern Zone Meeting, Sheraton-Dallas, Dallas.

**SPACIOUS** new reception room has special panelling, an antique clock, and a portrait of Parker Handy as . . .

## Handy & Harman Relocates Executive Offices

NEW YORK CITY: After transacting business in New York's famous financial district since 1967, Handy & Harman has moved its executive offices to 850 Third Avenue. Founded 94 years ago as a banking house, the company dealt exclusively in bullion, specie, and bonds. With the development of the silver and jewelry industries, the company became a source of semifabricated raw materials.

Today, Handy & Harman has terminated its banking operations, but remain the major supplier of precious metals for the jewelry and metalworking industries. The company is widely known for its silver brazing alloys and fluxes.

# Data Offered in This Month's Ads

*Readers may obtain any of these free reference materials by circling the corresponding numbers on the Reader Service Cards*

**2: Welding positioners** and manipulators are featured in literature. **Aronson Machine Co.**

**3: Calcium carbide** is featured. **Air Reduction Chemical & Carbide Co.**

**4: Iron powder,** low hydrogen electrode for mild steel, Class E-7018, is described in data. **Air Reduction Sales Co.**

**5: Stainless welding** with gas shielded metal arc process is discussed in literature. **Air Reduction Sales Co.**

**6: Electrodes** for joining, cutting, and shaping are featured. **All-State Welding Alloys Co., Inc.**

**7: Metal cutting** is explained in Bulletin DH-106. **Allison Campbell Division, American Chain & Cable Co., Inc.**

**8: Impact, abrasion, and corrosion** resistance at high temperatures is discussed in literature. **Alloy Rods Company**

**9: Brazing alloys** are listed in a catalog. **American Brazing Alloys Corp.**

**11: Joining dissimilar metals** is discussed. **Ampco Metals, Inc.**

**12: Metal cutting electrodes** are described in literature. **Arcair Company**

**13: Stainless filler metal products** are featured in literature. **Arcos Corp.**

**14: Technical assistance** is featured. **Arcos Corp.**

**15: Hole saw kits** are described in Bulletin HS-475. **Armstrong Blum Mfg. Co.**

**18: Iron workers** and accessories are described in literature. **Bateman Foundry & Machine**

**19: Reinforced resinoid** disc-wheels are described in literature. **Bay State Abrasive Products Co.**

**20: Carbon arc gouging** is featured in literature. **Becker Brothers Carbon Co.**

**21: Blowtorches** are featured in literature. **Clements Mfg. Co.**

**22: Clamps** for all jobs are featured in a catalog. **Cincinnati Tool Co.**

**24: A tong-type** a.c.-d.c. ammeter is featured in material. **Columbia Electric Mfg.**

**25: Pipe layout** equipment is featured. **Contour Sales Corp.**

**26: Acetylene gas cylinders** are featured. **Coyne Cylinder Company**

**27: Portable x-ray** units are featured in literature. **Curtiss Wright Corp., Princeton Div.**

**28: Welding and cutting** equipment is listed in a catalog. **Dockson Corp.**

**29: Electrode holders** are featured. **Duro Engineering Co.**

**30: Industrial x-ray** film is featured. **Eastman Kodak Company**

**31: Portable welder** is featured. **Emerson Electric of St. Louis**

**32: Toggle clamps** of all types are listed in catalog. **Erico Products**

**33: Columbium treated carbon steel,** GLX-W, is described in data. **Great Lakes Steel**

## OFFERED FOR THE FIRST TIME . . .

***The services and reference materials listed here are being offered for the first time in this issue by new WD&F advertisers.***

**1: Tungsten carbide** hard surfacing is featured. **A & B Metal Mfg. Co., Inc.**

**10: Buildup and joining electrodes** are featured. **American Manganese Steel Div., American Brake Shoe Co.**

**16: Personalized service** on steel fabrications is featured. **Art Welding Co.**

**17: Welding helmet** with push button lens is featured. **Auto-View Welding Helmet Co.**

**23: Hard facing electrodes** are featured. **Coast Metals, Inc.**

**42: Surface hardening** and heat treating compounds are described in a booklet. **Kasenit Co.**

**55: Hardening compound** for ferrous alloys is featured. **Precision Chemical Works.**

**70: Welders layout and cutting square** is described in literature. **R. C. Fessler & Co.**

*continued on page 76*

Circle No. 49 on Reader Service Card.

**No Other Product Can Do a Galvanizing Job Like**

***Galvalloy***

**Does - *HERE'S PROOF***

Heat welded seam on galvanized sheet to 600° with Torch

Rub GALVALLOY against heated surface as shown — now spread with wire brush for a bright finish.

***GALVALLOY Covers the Same Amount of Area with 1/5 the Amount of Material.***

Send today for Testing Sample and you'll learn Why GALVALLOY has no equal for ANY Galvanizing Job.

**METALLOY PRODUCTS CO.**
1233 S. BOYLE AVE., LOS ANGELES 23

**No other tool saves so much time and material...**

**Arcair process cuts rework time 93%!**

The Carson Machine & Supply Co., Oklahoma City, used Arcair torches to disassemble 10,000 J-47 stainless steel jet engine nozzle cones. Arcair did the job 93% faster than previous methods used and saved 89% on material costs!

You can save time and materials, too, with Arcair. Call your local Arcair dealer or write for further information. Arcair Company, 429 S. Mt. Pleasant St., Lancaster, Ohio.

*Arcair*®

Circle No. 12 on Reader Service Card.

## DATA FEATURED IN ADS

*continued from page 75*

**34: Axels, jacks, and couplers** are featured in a catalog. **Hammer Blow Tool Co.**

**35: Controlled flame cutting** is described in literature. **Heath Engineering Co.**

**36: Resistance welding alloys** and tips are featured. **Hercules Welding Products**

**37: Arc welding equipment,** accessories, and supplies are listed in a catalog. **Hobart Brothers Co.**

**38: Cryogenic equipment** and information is contained in a catalog. **Hofman Laboratories, Inc.**

**39: Iron bender** with 147 dies is featured in a bulletin. **Hossfeld Mfg. Co.**

**40: Flux recovery** equipment is described in a folder. **Invincible Vacuum Cleaner Mfg. Co.**

**41: Electrode holders** are described and illustrated. **Jackson Products**

**43: Electrode holders** and ground clamps are featured. **Lenco, Inc.**

**44: King-size facilities** are described in literature. **Lewis Welding & Engineering Co.**

**46: Tig welding** with a Heliard 'Tig-Twin' Kit is described. **Linde Company**

**47: Welding distributors** and how they serve local needs is described. **Linde Co.**

**48: New fabricating techniques** are discussed. **R. C. Mahon Company**

**49: Galvanizing welds** is the subject of data which includes a sample. **Metalloy Products Co.**

**50: Flame spraying hardfacing** is described in a bulletin. **Metco, Inc.**

**51: Shape cutting** machines are featured in literature. **Ohmstede Machine Works, Inc.**

**52: Automatic welding wire** is described in two folders. **Page Steel & Wire Div., American Chain & Cable Co., Inc.**

**53: Flaw hunting kit** is featured. **Picker X-Ray**

**54: Finding defects** is discussed. **Picker X-Ray**

**56: Seamless high-pressure** cylinders are described in catalog. **Pressed Steel Tank Co.**

**57: Leak proof hose connections** are described in a catalog. **Punch-Lok Co.**

**58: Backing rings** for pipe welding are featured. **Robvon Backing Ring Co.**

**59: Fabrications** of all sizes and types are available. **Steel Fabricators Co.**

**60: Hard-facing alloys** are featured in literature. **Stoody Company**

**61: Manganese electrode** for joining dissimilar carbon and alloy steels is featured. **Stulz-Sickles Company**

**62: Universal hardfacing electrode** for all-purpose use is featured. **Stulz-Sickles Co.**

**63: Piercing electrodes** for removing any metal are discussed. **Stulz-Sickles Co.**

**64: Hardsurfacing electrodes** that 'spray on' a thin layer of metal are discussed. **Stulz-Sickles Company**

**65: Electrodes** for resistance welding are listed in a catalog. **Tipaloy, Inc.**

**67: Gaugeless regulators,** single-stage or two-stage, are featured. **Victor Equipment Co.**

**68: Slotting-notching** of pipe, tubing is described in data. **Vogel Tool & Die Corp.**

**71: Temperature indicators** in adjustable holders are described. **Markal Co.**

## CLASSIFIED

*Cost of all ads in this section is $20 for the first inch and $15 for each additional inch or fraction. All classified advertising payable in advance.*


**FOR SALE**

One used Taylor-Winfield Butt Welder Serial #5343A, 440 Volt, 60 Cycle, 20 KVA, in excellent condition, with controls —$650. F.O.B. Worcester, Massachusetts

Parker Manufacturing Company
Worcester, Massachusetts

**STAHL EQUIPMENT CO.**
10 Ballard Street
Jamaica Plain, Mass.

Welding Platens — Used

**FOR SALE**
**INDUSTRIAL X-RAY**
**120 & 175 KVP Fedrex Unit**
**Used**
**Excellent Condition**
**Very Reasonably Priced**
Newport News Shipbuilding & Dry Dock Co.
Purchasing Department
Newport News, Virginia
PHONE: CHestnut 7-1211 Ext. 8448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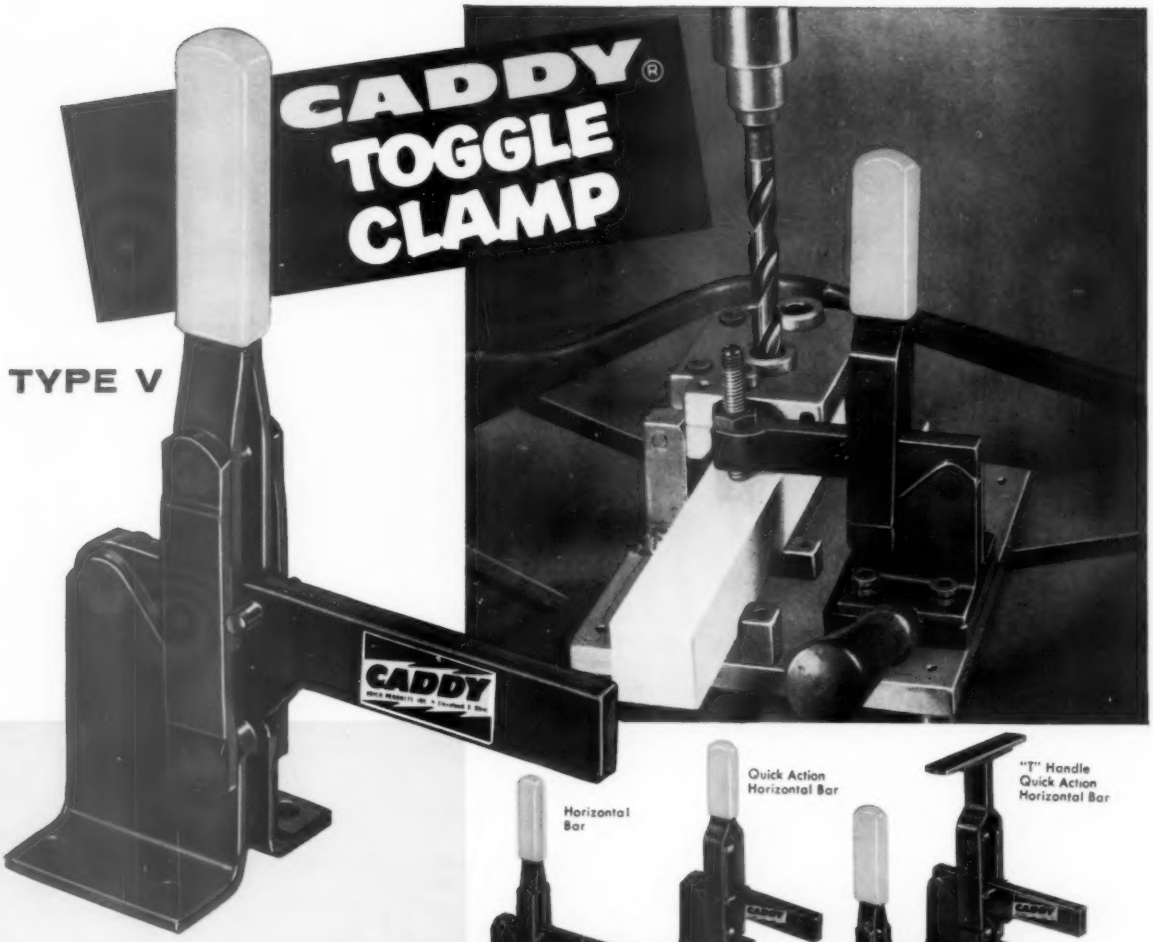
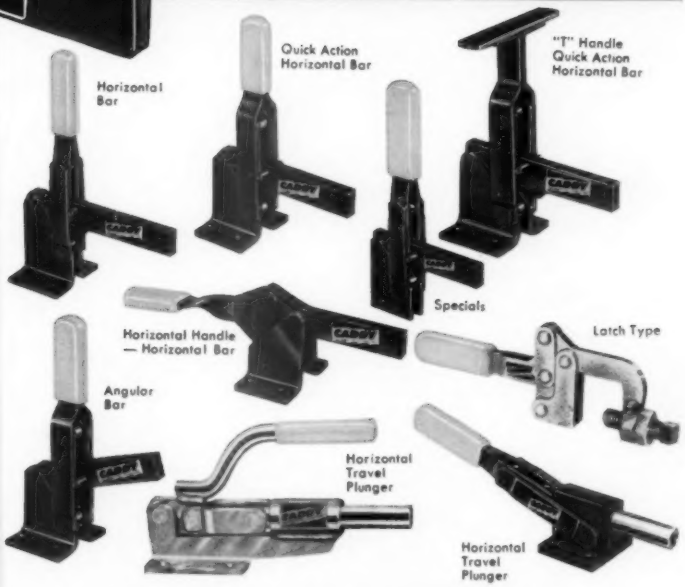
# CADDY® TOGGLE CLAMP

## TYPE V




**CADDY Type V Toggle Clamps feature all welded construction. Four sizes are available with clamping pressures from 800 lbs. to 2,000 lbs. Built to outlast any clamp on the market. Clamps have black finish with yellow plastic handles. Bolt retainer is furnished with each clamp.**

1. **EXTRA LARGE PIVOT PINS—Up to 3 times more bearing surface than other clamps. In actual test under load, V-3 clamp withstood 250,000 cycles without excessive wear.**
2. **ALL WELDED CONSTRUCTION—Will not come apart even after pins become excessively worn.**
3. **HEAVIER FRAME—Will not spring or bend under maximum load.**
4. **HEAVIER LINKS AND HANDLE—Will withstand extreme abuse. Pipe extension handle may be used without damage to linkage.**
5. **REINFORCED CLAMP BAR—Eliminates weak point where pivot pins pass through bar.**
6. **DOUBLE CLAMPING PRESSURE—Design of linkage provides double the clamping pressure of competitive clamps at the same pressure on the handle.**

# CADDY®

**Toggle Clamp Div. ERICO PRODUCTS, INC.**
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# Does VW have welding ideas for us?

It certainly does! Editor Chuck Berka (right) flew to Volkswagen's plant in Wolfsburg, Germany to give WELDING DESIGN & FABRICATION readers first-hand reports on the key part welding plays in producing this world-famous car. Automatic welding is VW's big secret. And Berka tells why in three highly informative and revealing articles. They are being published consecutively starting with this issue. The second, in August, will discuss VW and automatic resistance welding. The third, September, will cover automatic arc welding. Don't miss this important series . . . For that matter, check WELDING DESIGN & FABRICATION for the latest ideas, developments and techniques! And for full details on any item described or advertised in this magazine, use the handy Reader Service Cards bound into every issue.

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